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No.

IN THE
SUPREME COURT OF THE UNITED STATES

October Term, 1983

RAILROAD DYNAMICS, INC.,
Petitioner

v.

A. STUCKI COMPANY,
Respondent

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

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QUESTIONS PRESENTED

1. Whether, in a case where the validity of a patent is challenged on the grounds of obviousness, the failure to submit to a jury specific interrogatories patterned on the factual inquiries set forth by this Court in *Graham v. John Deere Co.* and the approval of a general verdict is error? The decision of the Court of Appeals for the Federal Circuit on this point is in direct conflict with decisions of other Courts of Appeal as well as with other panels of the Federal Circuit itself.

2. Whether the Court of Appeals for the Federal Circuit committed error in holding that the burden of proof imposed upon the patent challenger is unchanged, where the Patent Office did not cite prior art as pertinent as that introduced at trial? The holding of the Federal Circuit to that effect is in direct conflict with the decisions of every other Court of Appeals and the United States Court of Claims that the presumption of patent validity under 35 U.S.C. Section 282 is weakened or destroyed in such circumstances.

3. Whether, given this Court's recognition that issues of patent validity are issues of law subject to full review on appeal, the Court of Appeals for the Federal Circuit erred in failing to make an independent review of the record to determine if substantial evidence supported the jury verdict and if the patent in issue complied with applicable legal and constitutional standards for patentability?

IDENTIFICATION OF AFFILIATE OF PETITIONER

Worthington Industries, Inc. is an affiliate of Petitioner in that it owns 50% of the stock of Petitioner.

PETITION FOR WRIT OF CERTIORARI

TABLE OF CONTENTS

	Page
QUESTIONS PRESENTED	i
IDENTIFICATION OF AFFILIATE OF PETITIONER	i
TABLE OF AUTHORITIES	iv
OPINIONS BELOW	2
JURISDICTION	2
CONSTITUTIONAL PROVISION, STATUTES AND RULES INVOLVED	2
STATEMENT OF THE CASE	3
FACTUAL BACKGROUND	5
REASONS FOR GRANTING THE WRIT	6
THE REFUSAL OF THE COURT OF APPEALS FOR THE FEDERAL CIRCUIT TO REQUIRE SUBMISSION TO THE JURY, IN THE FORM OF SPECIAL INTERROGATORIES, OF THE FACTUAL INQUIRIES SET FORTH BY THIS COURT IN *GRAHAM V. JOHN DEERE CO.* IS IN CONFLICT WITH OTHER DECISIONS OF THE FEDERAL CIRCUIT ITSELF AND OF OTHER COURTS OF APPEAL	8
THE HOLDING OF THE COURT OF APPEALS FOR THE FEDERAL CIRCUIT THAT THE STATUTORY PRESUMPTION OF PATENT VALIDITY, BASED ON THE DOCTRINE OF ADMINISTRATIVE CORRECTNESS, IS NEITHER WEAKENED NOR DESTROYED WHERE THE PATENT OFFICE DID NOT CITE PRIOR ART AS PERTINENT AS THAT	

TABLE OF CONTENTS *(Continued)*

Page

INTRODUCED AT TRIAL, IS BOTH ILLOGICAL AND IN DIRECT CONFLICT WITH THE DECISIONS OF EVERY OTHER COURT OF APPEALS IN THIS COUNTRY 16

The Presumption of Validity Cannot Apply to the Obviousness Issue When the Patent Office Did Not Cite Prior Art as Pertinent as a Litigant's Prior Art 17

The Presumption of Validity, Based on a Presumption of Administrative Correctness, Cannot Apply to an Issue Not Considered by the Patent Office 24

THE FAILURE OF THE COURT OF APPEALS TO INDEPENDENTLY REVIEW THE RECORD TO DETERMINE IF SUBSTANTIAL EVIDENCE SUPPORTS THE JURY VERDICT AND IF THE PATENT COMPLIES WITH CONSTITUTIONAL STANDARDS OF PATENTABILITY IS INCONSISTENT WITH ITS CONDUCT IN OTHER CASES AND WITH THIS COURT'S RECOGNITION THAT QUESTIONS RELATING TO VALIDITY ARE ISSUES OF LAW SUBJECT TO FULL REVIEW ON APPEAL 26

CONCLUSION 29

APPENDIX ..... A-i

APPENDIX TABLE OF CONTENTS ..... A-ii

TABLE OF AUTHORITIES

Cases *Page*

American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350, 1356, 1361 (Fed. Cir. 1984) 8, 9, 10

American Seating Co. v. National Seating Co., 586 F.2d 611, 616 (6th Cir. 1978), *cert. denied* 441 U.S. 907 (1979) 19

Anderson's-Black Rock, Inc. v. Pavement Salvage Co., 396 U.S. 57, 61 (1969) 26, 27, 29

Baumstimler v. Rankin, 677 F.2d 1061, 1066, 1071-1072 (5th Cir. 1982) 14, 19, 23, 24

Black & Decker Mfg. Co. v. Ever-Ready Appliance Mfg. Co., 684 F.2d 546, 549 (8th Cir. 1982) . 19

Brush v. Condit, 132 U.S. 39, 48-49 (1889) 28

Christopher J. Foster, Inc. v. Newport News Shipbuilding & Dry Dock Co., 531 F.2d 1243, 1245 (4th Cir. 1975) 19

Connell v. Sears, Roebuck & Co., 722 F.2d 1542, 1547 (Fed. Cir. 1983) 10, 11

Dickey-John Corp. v. International Tapetronics, 710 F.2d 329, 337 (7th Cir. 1983) 19

Envirotech Corp. v. Al George Incorporated, Appeal No. 83-1107 (Fed. Cir. March 19, 1984), Slip Op'n at 20, 21 ..... 11, 12

Futorian Mfg. Corp. v. Dual Mfg. & Engineering, Inc., 528 F.2d 941, 943 (1st Cir. 1976) .. 19, 23

General Electric Co. v. United States, 572 F.2d 745, 761 (Ct. Cl. 1978) 19

Graham v. John Deere Co., 383 U.S. 1, 17-18 (1966) i, 3, 6, 8, 9, 10, 12, 13, 14, 15, 16, 29

TABLE OF AUTHORITIES *(Continued)*

Cases	*Page*
Great A. & P. Tea Co. v. Supermarket Corp., 340 U.S. 147, 155 (1950)	26
Manufacturing Research Corp. v. Graybar Electric Company, Inc., 679 F.2d 1355, 1360-1361 (11th Cir. 1982)	19, 23
McGill Inc. v. John Zink Company, Appeal Nos. 83-1198/1217 (Fed. Cir. April 27, 1984), Slip Op'n at 20	10
NDM Corp. v. Hayes Products, Inc., 641 F.2d 1274, 1277 (9th Cir.), *cert. denied* 454 U.S. 1123 (1981)	19
Northern Engineering & Plastics Corp. v. Eddy, 652 F.2d 333, 338 (3d Cir. 1981), *cert. denied* 454 U.S. 1146 (1982)	19
Perkin-Elmer Corp. v. Computervision Corp., Appeal No. 83-1195 (Fed. Cir. April 6, 1984), Slip Op'n at 8, 13-22	12, 27
Plastic Container Corp. v. Continental Plastics of Oklahoma, Inc., 708 F.2d 1554, 1558 (10th Cir. 1983)	19
Radio Corp. of America v. Radio Engineering Laboratories, Inc., 293 U.S. 1, 7-8 (1934)	24
Roberts v. Sears, Roebuck & Co., 723 F.2d 1324, 1339-1340, 1342-1343 (7th Cir. 1983)	13, 14
Saginaw Products Corp. v. Eastern Airlines, Inc., 615 F.2d 1136, 1140 (6th Cir. 1980)	24
Sakraida v. Ag Pro, Inc., 425 U.S. 273, 280 (1976)	26, 29
In re Sivaramakrishnan, 673 F.2d 1383, 1385 (C.C.P.A. 1982)	28

TABLE OF AUTHORITIES *(Continued)*

Cases	*Page*
Sperberg v. Goodyear Tire & Rubber Co., 519 F.2d 708, 714-715 (6th Cir.), *cert. denied* 423 U.S. 987 (1975)	14, 15
Sutter Products Co. v. Pettibone Mulliken Corp., 428 F.2d 639, 646-647 (7th Cir. 1970)	28
Triax Co. v. Hartman Metal Fabricators, Inc., 479 F.2d 951, 954 (2nd Cir.), *cert. denied* 414 U.S. 113 (1973)	19
Turzillo v. P & Z Mergentime, 532 F.2d 1393, 1399 (D.C. Cir.), *cert. denied* 429 U.S. 897 (1976)	19
Union Carbide Corp. v. American Can Company, 724 F.2d 1567, 1573 (Fed. Cir. 1984)	26
White v. Jeffrey Mining Machinery Company, 723 F.2d 1553, 1558 (Fed. Cir. 1983)	11
United States Constitution	
Article 1, Section 8, Clause 8	2
Statutes	
28 U.S.C. Section 1254(1)	2
28 U.S.C. Section 1295(a)(1)	7
28 U.S.C. Section 1338(a)	3
28 U.S.C. Section 2201	3
28 U.S.C. Section 2202	3
35 U.S.C. Section 103	2, 3, 8, 18, 19
35 U.S.C. Section 112	2, 17, 25
35 U.S.C. Section 282	i, 2, 7, 16, 17, 26
Federal Rules of Civil Procedure	
Rule 49	2

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RAILROAD DYNAMICS, INC.,
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v.

A. STUCKI COMPANY,
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PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Petitioner above named respectfully prays that a writ of certiorari issue to review the judgment and opinion of the United States Court of Appeals for the Federal Circuit (hereinafter "CAFC"), entered in this action on January 25, 1984, rehearing and suggestion for rehearing *in banc* denied on February 14, 1984.

OPINIONS BELOW

The opinion below of the panel of the CAFC is reported at 727 F.2d 1506 and at 220 USPQ 929. A copy of this opinion is set forth in the Appendix at A-1.[1] The Order of the CAFC denying Petitioner's Petition for Rehearing and Suggestion for Rehearing *In Banc* is unreported and is set forth at A-77.

The opinion of the United States District Court for the Eastern District of Pennsylvania, denying Petitioner's post-trial motions, is reported at 218 USPQ 618 and is set forth at A-34.

JURISDICTION

The decision of the CAFC in this case was dated and entered January 25, 1984. (A-1). The formal Judgment was entered February 14, 1984. (A-76). An Order denying Petitioner's Petition for Rehearing and Suggestion for Rehearing *in Banc* was entered on February 14, 1984. (A-77). The jurisdiction of this Court is invoked under 28 U.S.C. Section 1254(1).

CONSTITUTIONAL PROVISION, STATUTES AND RULES INVOLVED

> The Congress shall have Power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries. **United States Constitution, Art. I, Section 8, cl. 8.**

This case also involves the following sections of the patent laws, **Title 35, United States Code, Sections 103, 112 and 282.** The texts of the pertinent portions of these sections are set forth at A-78 and A-79.

This case also involves **Rule 49 of the Federal Rules of Civil Procedure.** The text of this Rule is set forth at A-79-80.

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1. The pages of the Appendix will be cited as "A-1, A-2. . . ."

STATEMENT OF THE CASE

In March 1976, Petitioner, Railroad Dynamics, Inc. (hereinafter "Petitioner") brought a declaratory judgment action in the United States District Court for the Eastern District of Pennsylvania[2] seeking a declaration that the patent in suit, U.S. patent 3,837,292 (the " '292 patent") (PX-2[3] at E-1-11), issued to Donald Wiebe and assigned to A. Stucki Company ("Respondent"), was invalid and not infringed. Respondent counterclaimed for patent infringement.

Liability was tried before a jury in May and June of 1980. Petitioner admitted infringement if the patent was held valid, but challenged the validity of the patent on numerous grounds, including, *inter alia*, obviousness and best mode. During the course of the trial, the District Court refused to submit special interrogatories to the jury as requested by Petitioner (A-81-83), which interrogatories were directed to the factual inquiries underlying a determination of whether or not a patent is obvious under 35 U.S.C. Section 103, as mandated by this Court in *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). Rather, the District Court, over Petitioner's objections, submitted to the jury with its instructions certain "Interrogatories to the Jury" which amounted to general verdict forms relating to the legal question of obviousness, *inter alia*. (A-26-28). The jury rendered a verdict on June 10, 1980 generally adverse to Petitioner,

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2. Jurisdiction was proper under 28 U.S.C. Sections 2201 and 2202 relating to declaratory judgments and under 28 U.S.C. Section 1338(a) concerning an action under Title 35 United States Code relating to patents.

3. "PX" designates the indicated Plaintiff's Exhibits introduced as evidence in the District Court. "E" designates the page of the separate exhibit appendix submitted herewith entitled "Appendix of Patents and Engineering Drawings To The Petition For A Writ Of Certiorari To The United States Court of Appeals For The Federal Circuit" containing patents and drawings which were introduced as documentary evidence in the District Court.

but determined that Petitioner's infringement was not willful. The damages phase of the litigation thereafter was tried to the Court in February 1981. The unreported decision awarding damages in the amount of $1,960,700 was rendered by the trial court on August 25, 1981.[4]

Both parties filed timely post-trial motions. Petitioner moved for judgment notwithstanding the verdict (hereinafter "JNOV") or, alternately, for a new trial, for revision of the damages award, and for a stay of execution. Respondent moved to alter or amend the judgment by increasing the amount of the damages award.

On March 28, 1983, the trial court entered a decision (hereinafter the "JNOV Memorandum"), reported at 218 USPQ 618 (A-34), denying all of the post-trial motions, except for the correction of a clerical error in the calculation of interest, resulting in a corrected damage award of $2,182,986. In its Memorandum opinion, the District Court made numerous findings of fact, particularly on the central issues of obviousness and best mode, despite the absence of any factual findings by the jury .

Petitioner thereupon renewed its motion for a stay of execution which was granted on April 29, 1983. Both parties appealed to the CAFC.

The CAFC rendered its decision on January 25, 1984 (judgment was entered February 14, 1984), affirming the jury verdict and holding that the district court's decisions on the parties' post-trial motions were correct and not an abuse of discretion. (A-1, A-34). The stay of execution was subsequently vacated, and Petitioner has been forced to seek refuge under the bankruptcy laws, since Petitioner could not post sufficient security pending disposition of this Petition and during subsequent proceedings in this Court. Petitioner thereupon filed this Petition.

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4. This decision is not reprinted in the Appendix, since it does not concern the issues raised in this Petition.

FACTUAL BACKGROUND

The '292 patent (E-1-11) relates to a combination of elements contained in the suspension system of a railway car, called a truck assembly. The invention is best understood by reference to Figure 8 of the '292 patent, which is colored for clarification as PX-77. (E-12).[5] All of the elements were old and well known prior art components of railway truck assemblies having the same general orientation as in the '292 patent.

The claims (E-10-11) provide for an improvement comprising a biasing spring arranged within a railway truck assembly to hold a hydraulic snubber spaced from either the bolster or the side frame (if the snubber and biasing spring assembly of Figure 8 were turned upside

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5. Figure 8 is a partial sectional view of a truck assembly in an unloaded railway car looking from the end of the car. The green side frame is carried on the wheeled axles, not shown. The blue bolster supports the body of the railway car, also not shown. The pink coil springs together form a "spring group" which supports the bolster ends within an opening formed in the side frames. An orange shock absorber, known as a "snubber" in the railway industry, replaces one of the coil springs in the truck assembly.

A red spring holds the snubber in a spaced position away from the side frame of the truck assembly when the railway car is unloaded. This red spring is called a "body spring" in the patent disclosure and a "biasing means" in the patent claims. When the railway car is unloaded, the red biasing spring holds the snubber in the spaced, inoperative condition shown in Figure 8 at the level of lines B-B. The inventor testified that the space between the end of the snubber's piston rod and the side frame is about ¾ inch when an unloaded railway car is supported by the truck assembly. When the railway car is loaded, however, or when the railway car rocks or bounces a sufficient amount, the pink coil springs and the red biasing spring are compressed so that the snubber contacts both the side frame and the bolster to absorb shocks as the railway car travels along the tracks. (T. 3.37-.38)*.

*"T." refers to the volume and page number of the Trial Transcripts in the District Court below, which are not included in the Appendix to this Petition. For example, T. 3.37-.38 refers to Volume 3, pages 37-38.

down) so that the snubber is "out of operative engagement" when the railway car is normally travelling in an unloaded condition, but is in contact with both the bolster and side frame and, therefore, is "in operative engagement" to absorb shocks when the railway car is loaded. For shorthand purposes, the invention claimed in the patent will be called an "unloaded-loaded arrangement" of a snubber in a railway truck assembly.

It is important to note that the evidence relating to the prior art, differences between the prior art and the claimed invention, and the meaning or significance of those differences, all relating to the issue of obviousness of the patent, were hotly contested by the parties. Moreover, the evidence relating to the issue of the failure to set forth the best mode of the invention in the patent was also disputed at trial.

REASONS FOR GRANTING THE WRIT

In a series of decisions both prior and subsequent to its determination of the case at bar, the CAFC has addressed the issue of whether a patent jury must be provided with special factual interrogatories patterned after the inquiries mandated by *Graham v. John Deere Co.*, *supra*.

In one of these cases, the CAFC reversed a jury verdict based upon the trial court's failure to submit such interrogatories to the jury; in other cases, including this case, the CAFC has expressed its strong preference for the employment of *Graham* interrogatories, but has nevertheless refused to overturn the verdicts on that ground. In none of its decisions has the CAFC provided any direction whatsoever to the lower courts or the patent bar as to the circumstances in which *Graham* interrogatories are required, or when they are unnecessary. The confusion which has arisen from these dramatically inconsistent decisions is substantial; the unfairness which has resulted from such rulings is great.

The fact that the CAFC itself has consistently refused to clarify its position on this issue, particularly given its exclusive appellate jurisdiction over patent cases[6], calls for review and resolution by this Court.

Similarly, this Petition presents important federal questions relating to the proper statutory presumption which is to be accorded to a patent under 35 U.S.C. Section 282. Eleven courts of appeals and the United States Court of Claims have held that, where the prior art presented by the patent challenger is more pertinent to the claimed invention than that considered by the Patent Office, the presumption of validity is weakened or overcome. Inexplicably, the CAFC has abandoned this well-established approach and has taken a position in direct conflict with the other circuit courts, by imposing upon the patent challenger, in circumstances where the doctrine of administrative correctness is inapplicable, the burden of proving invalidity by clear and convincing evidence. Unless this Court is willing to resolve this critical question and to reject the illogical, unworkable, and inequitable position taken by the CAFC, determinations of the Patent Office not based on the best evidence will be virtually irrefutable.

Finally, the refusal of the CAFC panel in this case to make an independent review of the legal issue of obviousness has brought into serious question the proper scope of review of patent jury decisions which is to be undertaken by the appellate court. As this Court has not reviewed a patent jury case since the enactment of the present patent statute in 1952, and as the CAFC has adopted inconsistent approaches in its review of patent jury decisions, clarification by this Court is essential.

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6. 28 U.S.C. Section 1295(a)(1), A-78.

THE REFUSAL OF THE COURT OF APPEALS FOR THE FEDERAL CIRCUIT TO REQUIRE SUBMISSION TO THE JURY, IN THE FORM OF SPECIAL INTERROGATORIES, OF THE FACTUAL INQUIRIES SET FORTH BY THIS COURT IN *GRAHAM V. JOHN DEERE CO.* IS IN CONFLICT WITH OTHER DECISIONS OF THE FEDERAL CIRCUIT ITSELF AND OF OTHER COURTS OF APPEAL

The serious conflict which exists within the CAFC itself and between the CAFC and other circuits regarding the need to submit to a patent jury, in the form of special interrogatories, the specific factual inquiries mandated *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966), in order to secure express and reviewable findings of fact[7], requires review and determination by this Court. The confusion which presently exists in this area is most markedly demonstrated by reference to the contradictory decisions of two panels of the CAFC, the first in *American Hoist & Derrick Co. v. Sowa & Sons, Inc.*, 725 F.2d 1350 (Fed. Cir. 1984), decided on January 12, 1984, *rehearing denied* February 15, 1984[8], and the sec-

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7. *Graham* set forth the facts to be considered in a determination of obviousness under 35 U.S.C. Section 103:

> Under Section 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at the issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

8. The panel in *American Hoist* comprised Judge Rich, who authored the opinion, Judge Kashiwa, and Senior Judge Cowen.

Counsel for Sowa & Sons, Inc. has advised the undersigned counsel for Petitioner that a Petition for Writ of Certiorari has been filed with this Court on May 9, 1984, No. 83-1827. Thus, this Court will have the opportunity to address the issue of the proper treatment of obviousness in patent jury trials, as well as the presumption of patent validity issue, by considering, at the same time, the positions of the parties in these two conflicting cases.

ond in the instant case decided only 13 days later, on January 25, 1984.[9]

In *American Hoist,* substantial evidence supported the positions of both parties. The jury rendered a decision against the patentee on the ground, *inter alia,* that the patent was invalid for obviousness. No findings of fact were made by the *American Hoist* jury. Its verdict consisted solely of responses to two legal issues relating to obviousness and fraud on the Patent Office. The trial court adopted the jury's determination of obviousness and, in its post-trial unpublished opinion, found facts in the record to support the jury's verdict. The CAFC panel reversed and remanded for a new trial, refusing to accept the presumption that the jury correctly determined the factual requirements of *Graham* in the absence of special interrogatories, and stated:

> We also agree with AmHoist that the district court *should have* submitted to the jury the factual inquiries underlying a Section 103 determination in the form of special interrogatories.
>
> * * *
>
> In performing its role with respect to Section 103, we assume that the district court recognized that it had no *express* findings of fact on which to base its legal conclusion. [Original emphasis]. *A district court may not solicit only a legal conclusion from the jury and then act as factfinder preliminary to expressing agreement with its legal determination. Id.* at 1361. [Emphasis Added.]

The *American Hoist* panel thus reversed a jury verdict on the ground that special interrogatories *must* be

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9. The panel in this case comprised Chief Judge Markey, the author of the majority opinion, in which Judge Friedman joined, and Senior Judge Nichols, who concurred in the result, but who had "serious qualms" about a single panel, rather than the twelve-judge court, setting forth broad guidelines for jury trials dealing with obviousness. (727 F.2d at 1523; A-31).

submitted to the jury on the controlling facts relating to obviousness.

> While we regret having to order a new trial before an already overburdened district county, a new trial is mandated, and this case is a good illustration of the difficulties inherent, generally, in the use of juries to resolve patent disputes and, specifically, *in allowing the use in such cases of general verdict forms unaccompanied by interrogatories on the controlling facts*. *Id.* at 1356. [Emphasis Added].

The instant case came to the CAFC in the very same posture as did *American Hoist*. Substantial evidence, particularly on the obviousness issue, was presented by the Petitioner. No express findings of fact were made by the jury, its verdict consisting solely of responses to legal issues. The trial court adopted the jury's determination of obviousness, and it too, in its post-trial opinion, found facts in the record allegedly supporting the jury's verdict. The CAFC panel in this case, however, either overlooked, misapprehended or ignored the precedent established in *American Hoist*, that the submission of the question of obviousness to the jury *must* be accompanied by detailed interrogatories designed to elicit responses to *at least* all of the factual inquiries mandated by *Graham*, approved the procedure followed by the trial court, and affirmed the verdict of the jury.

In the two other CAFC decisions reviewing jury trials prior to the decision in the case at bar and two CAFC decisions involving jury trial appeals subsequent to the case at bar, other CAFC panels strongly recommended submission of special interrogatories to the jury in patent infringement cases directed to the factual inquiries required by *Graham*.[10] In *Connell v. Sears, Roe-*

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10. Indicative of the CAFC's own uncertainty regarding the conflict which the CAFC itself has created, the Court, in *McGill Inc. v. John Zink Company*, Appeal Nos. 83-1198/1217 (Fed. Cir. April 27, 1984), Slip Op'n. at 20, declined to decide the issue of whether the trial court improperly failed to submit *Graham* factual inquiries relating to obviousness to the jury.

buck & Co., 722 F.2d 1542, 1547 (Fed. Cir. 1983), the CAFC's first review of a jury decision, the panel stated:

> Submission of the obviousness question to the jury *should therefore be accompanied by detailed special interrogatories* designed to elicit responses to at least all the factual inquiries enumerated in *Graham, supra*, and based on the presentations made in the particular trial. In so holding, we note the similar views expressed by other courts: *Control Components, Inc. v. Valtek, Inc.*, 609 F.2d 763, 767, 204 USPQ 785, 788 (5th Cir.), *cert. denied*, 449 U.S. 1022 (1980); *Velo-Bind Inc. v. Minnesota Mining & Mfg. Co.*, 647 F.2d 965, 971, 211 USPQ 926, 932 (9th Cir.), *cert. denied*, 454 U.S. 1093 (1981); *Manufacturing Research Corp. v. Graybar Electric Co.*, 679 F.2d 1355, 1365, n. 19, 215 USPQ 29, 36, n. 19 (11th Cir. 1982). [Emphasis added]

In *White v. Jeffrey Mining Machinery Company*, 723 F.2d 1553, 1558 (Fed. Cir. 1983), *rehearing denied* February 22, 1984, the CAFC determined that no issue of material fact was in dispute and reversed the jury decision and the trial court's refusal to overturn it by holding the involved patent invalid as obvious. Nevertheless, the *White* panel stated:

> . . . *interrogatories to juries should be directed to facts, not to questions of law such as obviousness* . . . which constitute the basis for instructions to the jury to guide it in reaching its conclusions of law. *Id.* at 1558n. 5. [Emphasis Added].

In *Envirotech Corp. v. Al George Incorporated*, Appeal No. 83-1107 (Fed. Cir. March 19, 1984), *rehearing denied* April 12, 1984, the CAFC stated:

> Submission of the obviousness question to the jury should preferably be accompanied by specified interrogatories designed to elicit responses to all the factual inquiries enumerated in *Graham*. Proper instructions based on those inquiries should always

> be given. . . . In the absence of such special findings and of a proper charge on which a conclusion of obviousness can be reviewed, and because the parties here are not yet in substantial agreement as to facts bearing on the obviousness issue, it is appropriate to remand the present case. *Id.* at Slip Op'n. at 20.

The admonition that, if a new jury trial occurs, "it would be preferable to submit at least detailed special interrogatories as to the facts enumerated in *Graham v. John Deere*," was again reiterated by the *Envirotech* panel in its Slip Opinion at 21n.11.

Further evidence of the extraordinary confusion generated by the decisions of the CAFC is its recent opinion in *Perkin-Elmer Corp. v. Computervision Corp.*, Appeal No. 83-1195 (Fed. Cir. April 6, 1984), *rehearing denied*, May 2, 1984. In that case, neither party requested that special verdicts or special interrogatories be submitted to the jury on the facts underlying the obviousness issue and neither party objected to the return of a general verdict as to whether or not certain claims of the involved patents were valid. Nevertheless, the CAFC stated:

> To facilitate review of a motion for JNOV and on appeal, it is preferred that a jury be provided with special interrogatories designed to reveal more clearly the findings it made. *Id.* at Slip Op'n. at 8.

The *Perkin-Elmer* panel also engaged in a careful and independent review of the evidence presented on the obviousness question, *id.* at 13-22, and was apparently influenced in its decision to affirm the jury verdict by its conclusion that "strong objective evidence" supported the nonobviousness conclusion. As is discussed *infra*, at 26-29, no such independent review of the evidence was performed by the CAFC panel in the matter *sub judice*.

Thus, in all of the CAFC's opinions relating to jury trials, the various panels at least strongly recommended, if not required, the submission of interrogatories to the

jury directed to the factual matters relating to obviousness. Yet guidelines as to when such interrogatories are required and when the failure to submit them to the jury is an abuse of the trial court's discretion have not been set forth by the CAFC.

It is clear from a review of the CAFC's decisions that the uniformity sought by the creation of the CAFC's exclusive jurisdiction has been undermined by that Court's own inconsistency. The CAFC's expression of a preference for the use of special interrogatories coupled with its refusal to provide any standard to trial courts on the question and the scattershot approach which it has employed in reviewing jury verdicts will continue to generate extreme confusion within the patent law and result in substantial inequities to litigants, as has in fact occurred in this case. Since the CAFC is unwilling to put its own house in order, as evidenced by its refusal to rehear the case at bar or the other cases where rehearing was sought on this very issue, this Court's intervention is required to put an end to the uncertainty which the decisions of the CAFC have created in the space of less than a year.

Furthermore, not only was the decision of the CAFC panel in the present case in conflict with prior and subsequent CAFC decisions on this point, but its ruling was also in conflict with prior decisions of other Circuit Courts of Appeal which have held that special interrogatories directed to the *Graham* factual inquiries should be submitted to the jury so that the judge can decide the legal question of obviousness based on the jury's findings of fact.

The Seventh Circuit, *in banc*, in *Roberts v. Sears, Roebuck & Co.*, 723 F.2d 1324, 1339-1340, 1342-1343 (7th Cir. 1983), reversed the jury verdict and held that special verdicts to the jury were required with respect to the subsidiary fact questions that composed the *Graham* inquiries, stating:

> . . . the trial court could not presume, nor may we, that the facts were found in favor of Roberts merely

> because the jury ultimately made the legal determination that his patent would not have been obvious. The trial court had no sufficient factual basis, presumed or otherwise, for ruling that the patent was "good and valid in law." *Id.* at 1342.

Beyond any doubt, if only a general verdict on obviousness is returned by a jury, factual determinations cannot thereafter be made by the trial court without improperly reversing the roles of judge and jury. Likewise, a reviewing court is powerless to determine intelligently whether or not a jury complied with the *Graham* requirements if the jury is not required to answer the specific *Graham* inquiries in returning its verdict. Just such a situation occurred in the case at bar.

In addition, Petitioner submits that it begs the question to argue that the jury must have found all the facts in Respondent's favor to reach its conclusion that the claimed subject matter is not obvious. To so reason would render every jury decision unassailable. The Court's admonition in *Baumstimler v. Rankin*, 677 F.2d 1061, 1066 (5th Cir. 1982), applies with substantial force here:

> The District Judge incorrectly allowed the jury to determine obviousness and validity, two issues which are clearly legal, not factual.
>
> * * *
>
> Special interrogatories . . . have especial value in a patent case tried to a jury. Their use is not only practical, facilitating appellate review and avoiding lengthy (as patent cases invariably are) retrial for even relatively minor errors in jury instructions, but accords with the inherent divisional lines between the roles of judge and jury, the boundaries of which are so easily transgressed in patent cases tried to juries. *Id.* at 1071-1072.

Likewise, in *Sperberg v. Goodyear Tire & Rubber Co.*, 519 F.2d 708, 714-715 (6th Cir.), *cert. denied* 423

U.S. 987 (1975), the Court held that the answers to two general interrogatories seeking the jury's opinion whether the patents were valid or invalid were "actually surplusage," but that submitting such questions to the jury was not improper, because the jury first made explicit factual findings. To the contrary in the present case, the trial court instructed the jury with respect to the *Graham* factual inquiries, but did not require the jury to make any findings or to answer any interrogatories concerning the factual inquiries.

Thus, this Petition raises issues relating to jury trials which are not merely academic. Petitioner's business is in jeopardy of liquidation, even though it has sought protection under the bankruptcy laws, as a result of a *presumption* that the jury understood the technology and correctly applied the facts it found to the legal issues involved in this case. Petitioner submits that a different result would have been reached and that the '292 patent would have been held invalid if the jury had been required to focus on the technology in response to specific *Graham* inquiries of the type Petitioner sought to have submitted to the jury. (A-81-83). At the very least, a review of the answers to such interrogatories would have enabled the trial court, the CAFC, and this Court to determine whether or not the jury understood the claimed invention and the prior art, and whether or not substantial evidence supported the facts reflected in the jury's answers to the interrogatories. By not remanding and requiring the trial court to submit the factual interrogatories to the jury, the CAFC in the present case rendered meaningful judicial review of the jury's verdict impossible.

In this case, the CAFC panel stated that "interrogatories seeking answers in writing to inquiries" per *Graham* "should be employed" and their use is "strongly recommended," (727 F.2d at 1516; A-16-17), and even provided in its Appendix B (727 F.2d at 1522-1523; A-29-30), sample interrogatories remarkably simi-

lar to those proposed at trial by Petitioner. (A-81-83). Inexplicably, however, the majority then stated:

> *Failure to submit detailed fact* interrogatories will not *in every case* result in the need for a new trial. Rule 49, Fed.R.Civ.P. (727 F.2d at 1517; A-17) [Emphasis added]

Obviously, this holding provides no guidelines whatsoever for trial courts or other CAFC panels, fails to comport with the CAFC and other courts' decisions, and severely hampers the creation of a unified body of law concerning the conduct of patent jury trials. As a result, the district courts and the bar are now left to cope, without assistance, with the CAFC's inconsistent rulings in all future patent jury trials.

Because of the CAFC's decisions in this and the other cases discussed above, a question of exceptional significance is yet unanswered: When is it necessary to submit to the jury interrogatories or special verdicts seeking answers in writing to the *Graham* inquiries, and when is it unnecessary to do so? The time is ripe, more than 30 years after the enactment of the 1952 Patent Act and almost 20 years since the *Graham* decision, for this Court to consider and decide this fundamental issue.

THE HOLDING OF THE FEDERAL CIRCUIT THAT THE STATUTORY PRESUMPTION OF PATENT VALIDITY, BASED ON THE DOCTRINE OF ADMINISTRATIVE CORRECTNESS, IS NEITHER WEAKENED NOR DESTROYED WHERE THE PATENT OFFICE DID NOT CITE PRIOR ART AS PERTINENT AS THAT INTRODUCED AT TRIAL, IS BOTH ILLOGICAL AND IN DIRECT CONFLICT WITH THE DECISIONS OF EVERY OTHER COURT OF APPEALS IN THIS COUNTRY.

The statutory presumption of patent validity is set forth in the first paragraph of 35 U.S.C. Section 282, which provides in pertinent part:

> The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting such invalidity.

The statute *appears* clear on its face, but it is far from clear in application. The present litigation highlights its lack of clarity with respect to the following issues:

> (a) What is the effect of the presumption where a litigant relies upon prior art more pertinent than the prior art considered by the Patent Office?
>
> (b) What is the effect of the presumption where patent invalidity is asserted on the basis of an issue not considered by the Patent Office (here, whether the patentee disclosed in its patent the best mode of making and using the invention as required by 35 U.S.C. Section 112)?
>
> (c) What is the effect of the presumption on the burden of proof of the party challenging patent validity in the circumstances described in paragraphs (a) and (b)?
>
> (d) What is the effect of the presumption on the proper manner of instructing the jury concerning the matters set forth in paragraphs (a)-(c) above?

Petitioner has found no cases in which this Court has specifically addressed the above issues. Given the clear conflict which exists in this area between the decision of the CAFC below and the position taken by every other Court of Appeals, and particularly in light of the exclusive appellate jurisdiction in patent infringement cases which has been accorded the CAFC, a determination by this Court of these critical questions is essential.

The Presumption of Validity Cannot Apply to the Obviousness Issue When the Patent Office Did Not Cite Prior Art as Pertinent as a Litigant's Prior Art

Petitioner submitted below and submits here that where patent validity is challenged under 35 U.S.C. Sec-

tion 103 based on prior art not cited by the Patent Office or based on other matters not considered by the Patent Office, such as the failure to disclose the best mode, the presumption of validity is weakened or overcome. At the least, in these instances, the burden placed upon the party challenging the patent should be no greater than by a preponderance of the evidence. This position was rejected by both the CAFC and the District Court below. The CAFC held:

> This court has said that the standard of proof of facts necessary to support a legal conclusion of invalidity is "clear and convincing". *It does not change upon a showing of prior art not considered in the PTO or from defense to defense. Connell, supra.*
>
> * * *
>
> *The presumption of validity is neither weakened nor destroyed where art more pertinent than that considered by the PTO is introduced;* the offering party is simply more likely to carry the burden of proving facts clearly and convincingly under those circumstances. *Medtronic, Inc. v. Cardiac Pacemakers, Inc.*, No. 83-820, slip op. at 5-6 (Fed. Cir. Nov. 23, 1983) [721 F.2d 1563 at 1566]. Similarly, Petitioner's argument that it was required to prove facts establishing its "failure to set forth the best mode" defense only by a preponderance, because that issue was not before the examiner, is without merit. 727 F.2d at 1516-1517; A-17-18. [Emphasis Added].

It is contended that the CAFC's holding is both illogical and in direct conflict with a prior decision of the United States Court of Claims, one of its predecessor courts, and with the decisions of every other Circuit Court of Appeals. Each of these courts has specifically held that, where more pertinent prior art is relied upon by the party challenging the patent than that considered by the Pat-

ent Office, the presumption of validity is at least weakened if not totally destroyed.[11]

In this case, Petitioner, in support of its assertion that the '292 patent is invalid on the grounds of obviousness under 35 U.S.C. Section 103, relied upon the following prior art, none of which was cited by the U.S. Patent Office in its review of the application which resulted in the '292 patent:

> (1) A truck assembly arrangement made and sold by the Holland Company and used by railroads several years prior to the effective filing date of the application for the '292 patent. The Holland arrangement was also illustrated and described in publicly distributed prior art engineering drawings as early as 1966 (PX-409 at E-13 (color-coded as PX-78 at E-14), and PX-417 at E-15). The Holland arrangement was an unloaded-loaded arrangement substantially as claimed in the '292 patent. (T. 2.116-.119; 3.42-.44; 3.117-.123; 4.103-.109).

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11. *E.g., Futorian Mfg. Corp. v. Dual Mfg. & Engineering, Inc.*, 528 F.2d 941, 943 (1st Cir. 1976); *Triax Co. v. Hartman Metal Fabricators, Inc.*, 479 F.2d 951, 954 (2nd Cir.), *cert. denied* 414 U.S. 113 (1973); *Northern Engineering & Plastics Corp. v. Eddy*, 652 F.2d 333, 338 (3d Cir. 1981), *cert. denied* 454 U.S. 1146 (1982); *Christopher J. Foster, Inc. v. Newport News Shipbuilding & Dry Dock Co.*, 531 F.2d 1243, 1245 (4th Cir. 1975); *Baumstimler v. Rankin*, 677 F.2d 1061, 1066 (5th Cir. 1982); *American Seating Co. v. National Seating Co.*, 586 F.2d 611, 616 (6th Cir. 1978), *cert. denied* 441 U.S. 907 (1979); *Dickey-John Corp. v. International Tapetronics*, 710 F.2d 329, 337 (7th Cir. 1983); *Black & Decker Mfg. Co. v. Ever-Ready Appliance Mfg. Co.*, 684 F.2d 546, 549 (8th Cir. 1982); *NDM Corp. v. Hayes Products, Inc.*, 641 F.2d 1274, 1277 (9th Cir.), *cert. denied* 454 U.S. 1123 (1981); *Plastic Container Corp. v. Continental Plastics of Oklahoma, Inc.*, 708 F.2d 1554, 1558 (10th Cir. 1983); *Manufacturing Research Corp. v. Graybar Electric Company, Inc.*, 679 F.2d 1355, 1360-1361 (11th Cir. 1982); *Turzillo v. P & Z Mergentime*, 532 F.2d 1393, 1399 (D.C. Cir.), *cert. denied* 429 U.S. 897 (1976); *General Electric Co. v. United States*, 572 F.2d 745, 761 (Ct. Cl. 1978).

(2) U.S. patent 1,983,088, issued December 4, 1934 to W. F. Kiesel, Jr. ("Kiesel") (PX-27 at E-16-19, Figure 2 being color-coded as PX-79 at E-20). Kiesel specifically illustrates and describes, in plain English, the unloaded-loaded arrangement claimed in the '292 patent (PX-27 at E-17, lines 19-27 and E-18, lines 5-17; T. 3.44-.51).

(3) U.S. patent 1,989,433, issued January 29, 1935 to T. H. Symington ("Symington") (PX-60 at E-21-25, Figure 2 being color-coded as PX-80 at E-26). Symington specifically illustrates and describes the unloaded-loaded arrangement (PX-60 at E-22, left column, lines 26-41 and E-23, right column, lines 1-13; T. 3.52-.58).

(4) Since the Holland arrangement and Symington patent disclose a snubber which operates on the principle of friction, rather than a hydraulic snubber, and since the internal operation of the Kiesel snubber is not specified, Petitioner also relies upon a one-page article published in the March 3, 1945 issue of *Railway Age* (PX-68, E-27). The *Railway Age* article discloses a Monroe hydraulic shock absorber for use in railway freight cars. Monroe's hydraulic snubber replaces a coil spring in a railway truck assembly and is located between the bolster and the side frame, the same position occupied by the '292 patent's hydraulic shock absorber which replaces a coil spring.

None of the prior art cited by the Patent Office discloses *any type of unloaded-loaded arrangement* of shock absorbers or snubbers in a railway truck assembly (T. 12.94).[12] Where snubbers are disclosed in the cited

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12. The Patent Office prior art references are Sproul U.S. patent 2,099,240 (PX-61 at E-28-31), Settles patent 2,573,165 (PX-69 at E-32-40), Williams patent 3,005,629 (PX-70 at E-41-46), Funkhouser patent 3,041,061 (PX-71 at E-47-51), Carter patent 3,145,055 (PX-72 at E-52-55), Blake patent 3,351,336 (E-56-63) and Seay patent 3,464,366 (PX-25 at E-64-74).

references, they are always in contact with and, therefore, in operative engagement with the bolster and side frame in both unloaded and loaded conditions.

The Holland arrangement and the Kiesel and Symington patents disclose the claimed unloaded-loaded arrangement. Under these circumstances, it is apparent that the U.S. Patent Office did not consider the best prior art.

Further, there is only one, insignificant difference between the claimed invention of the '292 patent and the Holland arrangement. Holland's unloaded-loaded arrangement uses a snubber which operates on the principle of friction, rather than hydraulics. However, Respondent itself admitted that this difference was immaterial, stating: "The novelty of a hydraulic snubber in a spring group is of no significance to the claimed Wiebe structure." (Stucki's Memorandum in Opposition to RDI's JNOV Motion, p. 32).[13] [14]

Over Petitioner's objection to submitting the ultimate issue of obviousness to the jury, the trial court stated in its jury instructions that, if the jury found that Petitioner's prior art was more pertinent than the Examiner's, the presumption of validity could be weakened or overcome. (T. 14.122-.123). However, the trial judge himself recognized that that instruction was unclear and not capable of being understood, and stated:

> You say that presumption of validity does not apply. I've used the third circuit case that you have cited

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13. Circuit Judge Nichols, in his concurring opinion below, recognized that this difference is meaningless:

> The *greatest difference* between the Holland and Stucki snubbers *was not patentably relevant, i.e.*, the Stucki device in suit was hydraulic and Holland's was not. 727 F.2d at 1524, A-33. [Emphasis Added].

14. It is uncontested that the level of ordinary skill in this art is that of a graduate engineer with several years of experience in the railway industry. (T. 2.48-.49; 3.138; 4.102-.103).

> here, the Phillips case, and I don't think it says that. It says it doesn't effect. It says it is weakened and I am telling them that. I am telling them what the third circuit says.
>
> The third circuit doesn't say it applies, just it is weakened. *What the devil that means, the jury will have to determine that.* (T. 13.89-.90). [Emphasis Added].

To further confuse the jury in its tasks, the trial court repeatedly stated in its jury instructions that Petitioner's burden of proof on all issues affecting patent validity was by the heavy burden of clear and convincing evidence. (T. 14.105-.117; 14.122-.123; 14.134-.137). These instructions resulted in the presentation of the following written jury interrogatories, to which Petitioner objected. (T. 14.148-.149):

> 1. Do you find that the plaintiff has proved by clear and convincing evidence that United States patent No. 3,837,292 is invalid on the ground of obviousness?
>
> * * *
>
> 6. Do you find that plaintiff has proved by clear and convincing evidence that United States patent No. 3,837,292 is invalid on the ground that the patent application failed to set forth the best mode contemplated by the inventor for carrying out his invention? (A-26-27).

These interrogatories and instructions set forth an improperly high burden of proof on Petitioner and therefore constituted reversible error.

As is clear on its face, Petitioner's prior art is more pertinent than the prior art cited by the Patent Office. Therefore, Petitioner submits that the trial court erred when it failed to instruct the jury and to provide a separate interrogatory, as Petitioner requested, that if the jury found Petitioner's prior art more pertinent than the

Patent Office's prior art, the burden of proof was lowered from "clear and convincing" to a preponderance of the evidence. Likewise, when the CAFC approved the trial court's actions, it adopted a position which is in direct conflict with every other Circuit Court of Appeals that has considered this issue.

Thus, for example in *Manufacturing Research Corporation v. Graybar Electric Company, Inc., supra,* 679 F.2d at 1360-1361, the Eleventh Circuit reversed a jury verdict where the district judge improperly instructed the jury to apply the clear and convincing evidence standard, rather than the preponderance of the evidence standard, when the alleged infringer introduced more pertinent art than that cited by the Patent Office. *Futorian Manufacturing Corp. v. Dual Manufacturing & Engineering, Inc., supra,* 528 F.2d at 943, involved a patent jury trial in which the trial court charged the jury that the alleged infringer had to prove invalidity only on the basis of a preponderance of the evidence standard, since the Patent Examiner did not consider the closest art to the claimed invention. The First Circuit Court of Appeals specifically approved this instruction.

In *Baumstimler v. Rankin, supra,* 677 F.2d at 1066, 1068, the Fifth Circuit reversed the trial court in circumstances similar to the case at bar. There, the trial court instructed the jury concerning the *Graham* factual inquiries, but left the ultimate determination of obviousness to the jury after instructing it that the party attacking the patent had to prove its case by clear and convincing evidence. The Court stated:

> Where the validity of a patent is challenged for failure to consider prior art, the bases for the presumption of validity, the acknowledged experience and expertise of the Patent Office personnel and the recognition that patent approval is a species of administrative determination supported by evidence, *Parker v. Motorola, Inc.,* 524 F.2d at 521, no longer exist *and thus the challenger of the validity of the patent*

> *need no longer bear the heavy burden of establishing invalidity either "beyond a reasonable doubt" or "by clear and convincing evidence". Id.* at 1066. [Emphasis Added].

And in *Saginaw Products Corp. v. Eastern Airlines, Inc.*, 615 F.2d 1136, 1140 (6th Cir. 1980), the Sixth Circuit similarly held that the burden of proof on an infringing party to establish its affirmative defenses is by a preponderance of the evidence.

No decisions of this Court have been located which address the appropriate burden of proof in such circumstances.[15] Therefore, for all of the reasons noted above, resolution of the conflict between the CAFC and the other circuits is necessary to dispel the confusion which presently exists and which, if not promptly resolved, will have a severe effect upon the conduct of all future patent validity trials.

The Presumption of Validity, Based on a Presumption of Administrative Correctness, Cannot Apply to an Issue Not Considered by the Patent Office

For the same reasons as are discussed above, the presumption of validity should also be reviewed by this

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15. This court, in *Radio Corp. of America v. Radio Engineering Laboratories, Inc.*, 293 U.S. 1, 7-8 (1934), held that the issuance of a patent is imbued with a presumption of validity and that a heavy burden of proof, greater than a preponderance of the evidence, must be met by a party challenging the patent. The parties in *Radio Corp.* were assignees of two inventors who made substantially the same invention at substantially the same time. An interference proceeding was conducted by the Patent Office to determine which of the two inventors was entitled to the patent. After the Patent Office's determination, the issue was again raised in several district courts and courts of appeal. No new prior art was relied upon. That case appears to be the most recent case in which this Court has referred to the presumption of validity of patents. The issue involved in the case at bar, the effect of the presumption of validity where the Patent Office did not cite prior art material to patentability, was not before this Court.

Court in the context of its effect on the burden of proof where the Patent Office did not consider the question of whether or not the patentee has disclosed in its application the best mode for making and using the claimed invention. 35 U.S.C. Section 112 provides, in pertinent part:

> The specification . . . *shall set forth the best mode contemplated by the inventor of carrying out his invention.* [Emphasis added].

Prior to filing the application for the patent, Respondent recognized there were problems with retaining its commercial shock absorber (the HS-6 snubber, illustrated in Figure 8 of the '292 patent) in the railway car's truck assembly. (T. 4.93-.94; 11.74-.75). To assure proper placement and retention of the snubber, Respondent interlocked the snubber to the bolster component of the railway car by applying lugs to the bolster and a pin to the snubber.

The inventor's testimony expressly confirmed that the lugs and pin structure was the best mode of installing the snubbers in the claimed unloaded-loaded arrangement and that such structure was known prior to filing the application for the '292 patent. (T. 11.69-.70). The inventor also testified that the lugs and pin structure should have been, but are not, disclosed in the application or in the patent. (T. 11.73).

Nothing in the patent file history in this case relates to the best mode issue. Indeed, the Patent Office never had cause to make and, therefore, never made any determination concerning this issue. The failure to disclose best mode can only come to light when the inventor and his patent are challenged. Thus, the doctrine of administrative correctness cannot apply in this context, thereby destroying any legal or logical basis for imposing such an onerous burden of proof upon the party asserting patent invalidity. The jury therefore should have been instructed that Petitioner's burden of proof on this issue was by a preponderance of the evidence.

This Court's consideration of the effect of the presumption of validity on prior art and issues not considered by the Patent Office is essential to provide proper guidance to the CAFC and trial courts, and the patent bar concerning the interpretation of 35 U.S.C. Section 282 and should also result in a reversal of the judgment in the instant proceeding.

THE FAILURE OF THE COURT OF APPEALS FOR THE FEDERAL CIRCUIT TO INDEPENDENTLY REVIEW THE RECORD TO DETERMINE IF SUBSTANTIAL EVIDENCE SUPPORTS THE JURY VERDICT AND IF THE PATENT COMPLIES WITH CONSTITUTIONAL STANDARDS OF PATENTABILITY IS INCONSISTENT WITH ITS CONDUCT IN OTHER CASES AND WITH THIS COURT'S RECOGNITION THAT QUESTIONS RELATING TO VALIDITY ARE ISSUES OF LAW SUBJECT TO FULL REVIEW ON APPEAL

This Court has made it clear that issues relating to patent validity, such as obviousness, are issues of law. *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 280 (1976); *Anderson's-Black Rock, Inc. v. Pavement Salvage Co.*, 396 U.S. 57, 61 (1969); *Graham v. John Deere Co., supra*, 383 U.S. at 17; *Great A.&P. Tea Co. v. Supermarket Corp.*, 340 U.S. 147, 155 (1950). Thus, while a determination of obviousness depends on the basic factual inquiries, the ultimate conclusion as to whether an invention would have been obvious at the time it was invented to one of ordinary skill in the art is a question of law.

Likewise, the CAFC itself, in decisions other than the case at bar, has treated obviousness as a matter of law subject to full review by an appellate court. In *Union Carbide Corp. v. American Can Company*, 724 F.2d 1567, 1573 (Fed. Cir. 1984), the Court stated:

> . . . this court reviews the issue of obviousness as one of law on which it *must* exercise independent judgment . . . . [Emphasis added]

In almost all *inter partes* cases other than the instant case, the CAFC has discussed in detail the scope and content of the prior art, the differences between the prior art and the claimed invention and the level of skill in the art. *E.g., Perkin-Elmer Corp. v. Computervision Corp., supra*, Slip Op'n. at 13-22. In this case, however, the CAFC abrogated its responsibility and made no independent determination as to whether the '292 patent was obvious or otherwise unpatentable.[16]

The first 23 typewritten pages of Chief Judge Markey's opinion for the panel generally are directed to the background, jury and obviousness issues. *Only two paragraphs* of that opinion addressed the substance of Petitioner's prior art not cited by the Patent Office and that discussion was directed only to that testimony relating to the actual prior public *use and sale* of the Holland arrangement (727 F.2d at 1513, right column, second paragraph, and 727 F.2d at 1514, left column, third paragraph; A-10, second paragraph, and A-11, third paragraph). However, even assuming *arguendo* the correctness of the determination of the majority of the panel below and of Judge Nichols that substantial evidence existed from which a reasonable jury could conclude that, as sold and used, "the Holland arrangement did not involve the spacing asserted by RDI" (727 F.2d at 1514; A-11) and that the "Holland device did not work in the manner asserted by RDI" (727 F.2d at 1524; A-33),[17] the use and sale of the Holland device represented only one aspect of the prior art Petitioner relied upon in this litigation.

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16. In failing to make such an independent review of the obviousness question, the issue of whether the patent could withstand constitutional scrutiny was never decided by the CAFC, as was required by this Court in *Anderson's-Black Rock, Inc. v. Pavement Salvage Co., supra*, 396 U.S. at 61.

17. The following portion of Judge Nichols' concurring opinion below nicely summarizes the obviousness issue raised on appeal:

> The *greatest difference* between the Holland and Stucki snubbers *was not patentably relevant, i.e.*, the Stucki device in suit was hydraulic and Holland's was not. 727 F.2d at 1524, A-33. [Emphasis Added].

The panel completely ignored Petitioner's documentary evidence, namely, the Holland arrangement prior art publicly distributed drawings and the Kiesel or Symington patents, all of which clearly disclose the claimed unloaded-loaded arrangement (see *supra*, at 19-20.) Independent review by the panel of these documentary exhibits would have disclosed what is plainly set forth in them: the unloaded-loaded arrangement claimed in the '292 patent. Further, assuming that the evidence, viewed in the light most favorable to Respondent, established that, in practice, the Holland, Kiesel, and Symington *snubbers* would not work in the field as disclosed in the published drawings and prior patents, these drawings and patent references, not cited by the Examiner, still disclose to one of ordinary skill in the art the unloaded-loaded arrangement claimed in the '292 patent.[18]

Thus, the panel below overlooked or misapprehended the essential fact that not only the Holland drawings but also the Kiesel and Symington patents disclose a snubber that was inoperative when the car was empty and operative only when the car was loaded as claimed in the '292 patent. There is no substantial evidence to refute this.

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18. As a matter of law, it is irrelevant if prior art devices work imperfectly or are not commercially successful. So long as the prior art teaches what is claimed in the patent in suit, it is an effective reference. *Brush v. Condit*, 132 U.S. 39, 48-49 (1889); *In re Sivaramakrishnan*, 673 F.2d 1383, 1385 (C.C.P.A. 1982). In *Sutter Products Co. v. Pettibone Mulliken Corp.*, 428 F.2d 639, 646-647 (7th Cir. 1970), the Court stated:

> Inefficiency, even to the point of practical ineffectiveness, does not necessarily invalidate an invention as prior art in all its aspects. *Dalin v. Watson, supra* [92 U.S.App.D.C. 270], 204 F.2d [730] at p. 732. So long as it embodies the same construction and principle as the alleged invention, a structure is effective as prior art even though the construction of the machine is crude, or the machine is imperfect in operation. *Zephyr American Corporation v. Bates Mfg. Co.*, 128 F.2d 380, 385 (3d Cir. 1942).

Such documentary prior art independently and conclusively proves the claimed invention obvious, thereby rendering the '292 patent invalid. Had the CAFC panel undertaken to review the evidence on the issue, it would have been compelled to reach just such a conclusion.

This Court has not shied away from determining whether patents before it have satisfied applicable consitutional and statutory standards. In *Graham*, *Anderson's-Black Rock*, and *Sakraida*, this Court found that the involved patents did not meet such standards, reversed the circuit court decisions, and held the patents at issue invalid. Petitioner submits that a like result not only is warranted but is mandated in the present case.

CONCLUSION

For all of the foregoing reasons, a writ of certiorari should issue to the Court of Appeals for the Federal Circuit so that this Honorable Court may resolve the direct conflicts which exist within the Federal Circuit and between the Federal Circuit and the other Courts of Appeals, and may correct the decision below.

Respectfully submitted,

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APPENDIX TO PETITION FOR WRIT OF CERTIORARI

APPENDIX

TABLE OF CONTENTS

	Page
Decision of the United States Court of Appeals for the Federal Circuit, dated Janaury 25, 1984	A-1
Memorandum and Order of the United States District Court for the Eastern District of Pennsylvania, dated March 25, 1983	A-34
Judgment from the United States Court of Appeals for the Federal Circuit, dated January 25, 1984	A-76
Order from the United States Court of Appeals for the Federal Circuit, dated February 14, 1984	A-77
28 U.S.C. 1295(a)(1)	A-78
28 U.S.C. 1338(a)	A-78
35 U.S.C. 103	A-78
35 U.S.C. 112	A-79
35 U.S.C. 282	A-79
Federal Rules of Civil Procedure, Rule 49	A-79
Plaintiff's Revised Proposed Special Verdict questions	A-81

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

Appeal Nos. 83-951/961

RAILROAD DYNAMICS, INC.,
Appellant/Cross-Appellee,
v.
A. STUCKI COMPANY,
Appellee/Cross-Appellant.

Decided: January 25, 1984

Before MARKEY, *Chief Judge,* FRIEDMAN, *Circuit Judge,* and NICHOLS, *Senior Circuit Judge.*

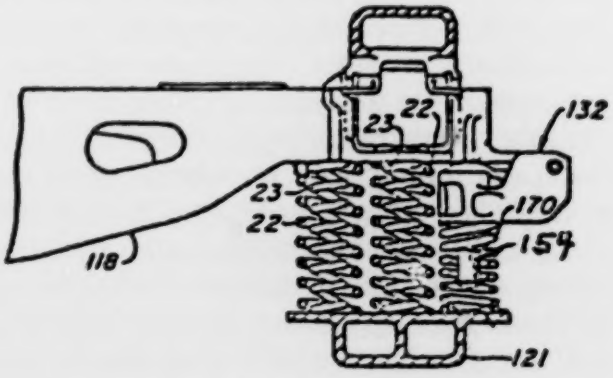
MARKEY, *Chief Judge.*

Appeal from a judgment of the District Court for the Eastern District of Pennsylvania denying motions for judgment notwithstanding the verdict (JNOV) and for a new trial. U.S. Patent No. 3,837,292 ('292 patent), assigned to A. Stucki Co. (Stucki), was held valid and found infringed. Damages were awarded in the amount of $2,182,986. We *affirm.*

Background

The Invention

Figure 8 of the '292 patent is illustrative:



A railroad freight car (not shown) has beneath it four side frames 121, each carrying two of the car's eight wheels (not shown). Springs 22, 23 are grouped between the wheels in each side frame and act as shock absorbers. Each end of the car rests on a bolster 118 extending between the side frames at each side of the car, each end of the bolster resting on the springs.

In operation, freight cars tend to rock from side to side, a phenomenon known in the industry as "rock and roll". Severe rocking and rolling can cause derailment.

The '292 patent discloses as a solution to rock and roll the replacement of one of the springs with a hydraulic shock asborber assembly (snubber) 132. A spring 170 holds the snubber normal to the bolster and biases the hydraulic piston rod 154 out of contact with frame 121 when the car is lightly loaded. The snubber operates only when the car is loaded or bounces sufficiently to compress the springs to the point at which the hydraulic rod 154 of the snubber contacts the frame (or, when the snubber is reversed in position, the point at which the rod contacts the bolster).

Claim 1 is representative:

> 1. In a dampened railway truck assembly selectively operable in loaded and unloaded conditions and having a hydraulic snubber apparatus interposed in a spring group intermediate a bolster member and a side frame member, the improvement comprising: means interposed between said snubber apparatus and one of said members to bias said snubber apparatus out of operative engagement with said one of said members when said truck assembly is normally operating in an unloaded condition; and said means and said snubber apparatus being cooperable to initiate hydraulic snubbing by said snubber apparatus substantially only when said railway truck assembly is normally operating in a loaded condition, the bias of said means is partially

overcome and said snubber apparatus is in operative engagement with both of said members.

Procedural History

Railroad Dynamics, Inc. (RDI) brought a declaratory judgment action against Stucki in 1975, seeking a declaration of patent invalidity. Stucki counterclaimed for infringement.

RDI admitted infringement and the liability issue was tried to a jury for three weeks (May 19, 1980 to June 10, 1980). The trial judge gave detailed instructions to the jury, covering over 51 pages of the record. The jury answered in writing ten inquiries labeled "interrogatories", each of its answers favoring Stucki. The parties agree that the jury's answers amounted to a general verdict in favor of Stucki.

The damages issue was tried to the court from February 9, 1981 to February 20, 1981. The court in an unreported Memorandum established a reasonable royalty of $35.00 per carset (four snubbers) plus 6% interest. On August 25, 1981, the court issued an Order that judgment be entered in favor of Stucki for $1,960,700. Judgment was entered on August 26.

RDI moved for JNOV or for a new trial and objected to inclusion of royalties on certain carsets in the award. Stucki moved to alter or amend judgment by increasing the amount of the award.

Judge Broderick, in a careful and exhaustive Memorandum published at ____ F.Supp. ____, 218 USPQ 618, reviewed all the evidence, and denied the post trial motions of RDI and Stucki (except for correction of a clerical error in the calculation of interest). The district court entered an Order on March 25, 1983 that the August 26, 1981 judgment be corrected, *nunc pro tunc*, in favor of Stucki for $2,182,986. Final judgment was accordingly

entered March 28,[1] 1983, or some seven years after suit was filed.

Issues

(A) Whether the judgment entered on the jury verdict is supported in the record.

(B) Whether the district court erred in: (1) submitting a legal issue to the jury; (2) submitting interrogatories to the jury; (3) instructing the jury; (4) failing to declare invalidity for lack of oath or declaration.

(C) Whether the district court erred in determining the amount of damages.

OPINION

Standard of Review — In General[2]

It is judgments that are appealed. Because a final judgment issues in favor of the movant, it has been said that "an order granting a motion for JNOV is appealable". Orders denying a motion for JNOV and granting or denying a motion for new trial do not generally result in judgments and are not themselves appealable. 5A Moore's Federal Practice ¶56.16 (2d ed. 1983). In those latter instances, the only appealable judgment is that entered on the jury's verdict.

Where no post-trial motions of the type discussed here were filed, and the appeal is directly from the judg-

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1. Damages were awarded on this basis:

	RDI Carsets Shipped	Royalty ($35.00/ Carset)	Royalty with Compound Interest at 6%
12/1/74-4/30/75	2,406.75	84,236	124,400
5/1/75-4/30/76	5,043.00	176,505	245,977
5/1/76-4/30/77	6,805.00	238,175	312,105
5/1/77-4/30/78	7,145.00	250,075	309,493
5/1/78-4/30/79	9,488.00	332,080	386,807
5/1/79-4/30/80	13,296.00	465,360	513,013
5/1/80-2/09/81	7,999.75	279,991	291,191
TOTAL	52,183.50	1,826,422	2,182,986

2. This section is distasteful dicta deemed desirable only in view of the growing incidence of jury trials in patent cases and the indication of need in the briefs here and in other appeals

ment entered on the jury's verdict, review for sufficiency of evidence is extremely limited or non-existent, prejudicial legal error must be shown to have occurred in the conduct of the trial, and the action of an appellate court is limited to affirmance or remand for new trial. *See Lenard v. Argento*, 699 F.2d 874, 888 (7th Cir. 1983); *Scientific Holding Co. v. Plessey, Inc.*, 510 F.2d 15, 28 (2nd Cir. 1974). It thus behooves counsel to file non-frivolous motions for directed verdict, for JNOV, and for new trial.

Similarly, where there has been no motion for JNOV under Rule 50(b) Fed. R. Civ. P., and nothing of record that may be treated as such a motion, an appellate court cannot reverse or order judgment for appellant. *Cone v. West Virginia Pulp & Paper Co.*, 330 U.S. 212 (1947); *Globe Liquor Co. v. San Roman*, 332 U.S. 571 (1947); *Johnson v. New York, New Haven & Hartford Railroad Co.*, 344 U.S. 48 (1952). Moore's, *supra*, ¶50.12. An appeal may not be treated as a substitute for a motion for JNOV that was not made to the district court.

Though it has been said that a district court presented with a motion for JNOV must determine whether there was "substantial evidence to support the verdict", *See Connell v. Sears, Roebuck & Co.*, Nos. 83-841/842, (Fed. Cir. Nov. 23, 1983), the quoted phrase must not be taken as applicable in the same manner to all issues encompassed in the verdict or in a manner that would disregard the proper placement of the burden of proof. For example, the verdict may be for the patent owner, necessarily implying a conclusion that the patent is valid. The quoted phrase must not be taken in that case as meaning that the district court, in considering a motion for JNOV attacking validity, determines only whether the patent owner had introduced sufficiently substantial evidence to support that conclusion. That approach would, contrary to the statute, 35 U.S.C. §282, shift to the patent owner the burden of proving facts establishing validity.

Patent owners are never in law required to prove facts establishing validity, though they may when necessary be well advised to prove such facts in rebuttal of a patent challenger's case. When they do, a verdict of validity may be sustained on the failure of the challenger to meet its burden in light of the rebuttal evidence.

The burden placed on patent challengers by §282 is not undue. There are many grounds for challenging a patent. Challengers often press them all; and challengers win if they establish only one.

When a jury verdict of validity is tested by a motion for JNOV, therefore, the district court must determine whether the patent challenger's evidence met the burden imposed by §282. If that evidence be such as to have so withstood the patent owner's rebuttal evidence that reasonable jurors could not have concluded that the patent is valid, the motion should be granted. If the patent challenger's evidence fails that test, the motion should be denied.

When the verdict connotes invalidity, a properly instructed jury has necessarily determined that the patent challenger's evidence met the burden imposed by §282. A district court presented with the patent owner's motion for JNOV would apply the same test, i.e., whether reasonable jurors viewing the challenger's evidence could or could not have reached the conclusion that the patent is invalid.

Respecting infringement, the shoe is on the other foot, for there the burden is on the patent owner. Whether the verdict be for the patent owner or alleged infringer, a motion for JNOV attacking the infringement finding must be tested on whether the patent owner's evidence was such that reasonable jurors could or could not have determined that the claims were or were not infringed.

Standard of Review — This Case

The present denial of a motion for JNOV, though not appealable, is reviewable in connection with the appeal from the judgment entered on the verdict. When a motion for JNOV has been granted, the judgment on review is that entered by the trial judge, not the judgment that would have been entered on the verdict. Whether the motion was denied or granted, appellate review follows the decisional path, discussed *infra*, trod by the trial court. Moore's, *supra*, ¶50.07.

Similarly, though the denial or grant of a motion for new trial is not appealable, a denial of that motion is reviewable in connection with the appeal from the judgment entered on the verdict. Review is conducted, however, on an abuse of discretion standard. Moore's, *supra*, ¶59.15[3].

Where, as here, a motion for JNOV was denied, appellee may assert grounds that would entitle him to a new trial if denial of the motion for JNOV is held to have been in error. Rule 50(d), Fed. R. Civ. P. Stucki's assertions in support of the verdict and the denial of RDI's motions may be considered an assertion of such grounds here.

Where, as here also, motions for JNOV and for new trial have been denied, an appellate court may affirm the denial of the former, reverse the denial of the latter, and order a new trial. Moore's, *supra*, ¶50.15.

Though the foregoing rules and decisions govern the standards of review and actions open to an appellate court on appeals from judgments entered under various circumstances following a jury trial, the parties here have essentially ignored those rules and decisions. RDI does not directly assert that the jury's verdict resulted from prejudicial legal error. It does argue error in the denial of its motions (directly respecting its motion for JNOV; indirectly respecting its motion for new trial, i.e., by asserting error in the conduct of the trial).

RDI disregards the trial court's Memorandum. Except for a mention of "the patent monopoly" and a one sentence reference to *Roberts v. Sears, Roebuck and Company*, 697 F.2d 796 (7th Cir.) *vacated and remanded en banc*, No. 82-1886 (7th Cir. Dec. 21, 1983), that Memorandum reflects a thorough, unchallengeable statement of the factual and legal basis for denial of RDI's motions, as well as a correct application of the law and procedure governing jury trials in patent cases and the determination of damages in this case.

One who appeals from a judgment entered on a verdict absent post trial motions, from a judgment entered on the grant of a motion for JNOV, from a judgment entered on a verdict after denial of a motion for JNOV, or from a judgment entered on a verdict after denial of a motion for new trial, if he would not waste the court's time and his client's money, must comply with the applicable rules. If the first, appellant must come prepared to show that prejudicial legal error occurred at trial. If the second or third, appellant must come prepared to show that the jury's factual findings were not supported by substantial evidence, or if they were, that the jury's legal conclusion was not supported by those facts. If the last, appellant must come prepared to show an abuse of discretion in denying the motion for new trial.

Though the present appeal is from the judgment entered on the jury's verdict, the denial of RDI's motion for JNOV is, as above indicated, reviewable. Because review of the latter encompasses the former, they may be discussed together. In light of the record and the presentation of the parties, we consider together under (A) the jury's verdict and the denial of the motion for JNOV, we consider under (B) the denial of RDI's motion for new trial in light of its attacks on the conduct of the trial in relation to the jury's verdict, and we consider under (C) the judgment of the court entered on the damages proceeding.

(A) JNOV — The Jury's Verdict

Upon presentation of a motion for JNOV following a jury verdict on patent validity, the district court must first consider the fact evidence and draw reasonable inferences in a light most favorable to the non-moving party, without determining credibility or substituting its choice for that of the jury when conflicting elements appear in the substantial probative fact evidence. The moving party is entitled to JNOV when the court is convinced: (1) that reasonable persons could not in light of that evidence have found the facts necessary to support the jury's verdict; *or* (2) that the facts properly found cannot in law support that verdict. If, on the other hand, the court is convinced that reasonable persons could have found in light of that evidence all the facts necessary to support the jury's verdict, denial of the motion for JNOV is required. *Connell, supra,* slip op. at 5.

Thus the trial judge engages in a two step process when presented a motion for JNOV: (1) determine what facts are supported by substantial evidence; and (2) determine whether those facts support the legal conclusion necessarily drawn by the jury enroute to its verdict.

In conducting the first step, the trial judge avoids invasion of the jury's province by respecting its right to select reasonably from the probative evidence and to determine credibility. In conducting the second step, the judge avoids a miscarriage of justice by reaching, when the rules render it necessary, a legal conclusion different from that of the jury. Because of the respect due the constitutional right to a jury trial, the rules relating to the judge's role necessarily limit that judicial interposition to instances in which the underlying facts found by the jury (in writing or as implied from its return of a general verdict) are either not themselves supported by substantial evidence or, if so supported, cannot in turn support the jury's legal conclusion.

Thus the judge who was present at trial is best positioned, when presented a motion for JNOV, to review in

detail the evidence and events at trial. In the present case, our decisional approach is aided by the trial judge's review and his Memorandum setting forth his reasons for denying the motion for JNOV.

Our review of Judge Broderick's thorough Memorandum coupled with consideration of the parties' presentations on appeal, leads inescapably to the conclusion that RDI's motion for JNOV was properly denied.

The thrust of RDI's arguments here center around a piece of non-patented prior art known as the Holland arrangement. In that arrangement a stiff spiral or "volute" is placed between the bolster and the frame. The dispute at trial was whether the spiral was, unlike the snubber of the claimed inventions, in contact with the bolster and frame. RDI says the Holland arrangement is spaced like the claimed snubber and is therefore more pertinent than the art considered by the Patent and Trademark Office (PTO), and that it would have rendered obvious the inventions claimed in the '292 patent. On that basis, RDI argues that there is evidence of record which would support a grant of its motion for JNOV.

RDI says that because "the issue of obviousness is a legal conclusion, albeit based on evidence in the form of facts", that issue is "fully reviewable by this court *de novo*". The assertion is at best confusing. Every legal conclusion must be based on facts established by evidence. "*De novo*" review means a totally new fact-finding effort.

We do not sit as fact-finders. Given the facts supported by substantial evidence, we are certainly at liberty, as is the trial court, to say that the jury committed an error of law in reaching its conclusion on obviousness when those facts will not in law support the conclusion. But that is quite another thing from what is desired by RDI.

As appellants are wont to do, RDI seeks a second trial, albeit at this level. In arguing for "*de novo*" review of the obviousness "issue", RDI would render a trial of

that question unnecessary, for all that would be necessary under RDI's proposal is that the parties mail us the patent and the prior art and ask whether we think the claimed invention would have been obvious or unobvious.

Thus RDI misconceives our role as an appellate court. In the concert hall of justice, each musician has a part to play. When one on whim plays not his own but another's part, discord is certain. Moreover, our parts are played under well defined rules. When a player elects to play under special rules of a personal design, though his playing should satisfy so sweetly the justice of his inner ear, the concert itself cannot succeed. The roles and rules of trial and appellate courts are distinct and distinctly designed for harmony. Hence, we reject RDI's invitation to consider the Holland arrangement evidence *de novo* and to reach our own conclusion on obviousness in a vacuum, as though the many events before this appeal never occurred.

That there may have been trial evidence favorable to both sides, i.e., to RDI and to Stucki, is simply irrelevant. There usually is. At oral argument, RDI responded to this court's indication that it did not sit to review evidence *de novo* with an assertion that there is *no* evidence favorable to Stucki. That assertion is unfounded. The ample evidence favorable to Stucki is discussed by Judge Broderick at ____ F.Supp. ____, 218 USPQ 625-26.

RDI's "no evidence" assertion is shorthand for its disagreement with first the jury's and now the district court's view of the evidence, in particular the expert testimony that contact of the bolster with the spiral occurs in the Holland arrangement. Under the rules governing our jurisprudence, the jury had a right to credit that factual expert testimony, and, under those rules, the trial judge could not deprive the jury of that right by substituting his own credibility determination. Nor may we by substituting ours. Because reasonable persons, crediting that testimony, could have found that the Holland ar-

rangement did not involve the spacing asserted by RDI, the denial of RDI's motion for JNOV was required.

RDI's other attacks on the jury's verdict that are couched in terms of attacks on the denial of its motion for JNOV are without merit.

(B) Denial of New Trial Motion

Though not so designated, RDI's assertions of error in the conduct of the trial (issues (B)(1), (2), and (3)) are attacks on the denial of its motion for a new trial. These attacks would if sustained warrant a new trial (not, as RDI appears to assume, a reversal and judgment for it). As appears below, no basis exists for declaring the denial of RDI's motion for new trial to have been an abuse of discretion.

(B)(1) Submitting A Legal Issue to the Jury

RDI strenuously asserts error in the submission of the question of obviousness to the jury, citing language from an opinion of another court seeming to so state.

This court has held that it is not error to submit the question of obviousness to a jury. *Connell, supra,* slip op. at 6. As stated in *Connell,* there is no reason for distinguishing the submission of legal questions to a jury in patent cases from the routine submissions of legal issues to juries in other types of cases.

Language appearing elsewhere, to the effect that a jury "made no findings" when it returned a general verdict, or that the legal conclusion regarding obviousness must "always be made by the judge and not the jury", are as so broadly stated difficult to understand. A jury always and necessarily makes findings (albeit unwritten) before it reaches its general verdict. Similarly, a jury necessarily reaches a legal conclusion, presumably in accord with the judge's instructions on the law, before it reaches its general verdict. Moreover, it is idle to speak of the jury solely as fact finder, so long as instructions on the law and general verdicts remain elements of a jury trial.

When and if Rules 49, 50, and 51, Fed. R. Civ. P., are repealed, there may be room for the restriction of juries to a fact finding role and for prohibition of general verdicts in patent or other types of jury trials. Until that day, a prohibition of general verdicts (and disregard of the findings and legal conclusions a jury must make in reaching those verdicts) cannot be accomplished by judicial fiat.

There is, of course, no reason for considering patent cases as somehow out of the mainstream of the law and rules of procedure applicable to jury trials for centuries under our jurisprudence. Until waiver of jury trials was permitted by the Act of March 3, 1865, ch. 86, §4, 13 Stat. 501, all cases at law were tried by juries. The comparatively recent resurfacing of jury trials in patent cases, though productive of discomfort for some judges and commentators, may or may not be wise or welcome; it forms no basis for creation of special and unauthorized rules, or for the consequent risk of effectively denying the constitutional right spelled out in the first clause of the Seventh Amendment.

Thus it is neither error nor dangerous to justice to submit legal issues to juries, *the submission being accompanied by appropriate instructions on the law from the trial judge*. The rules relating to interrogatories, jury instructions, motions for directed verdict, JNOV, and new trial, and the rules governing appeals following jury trials, are fully adequate to provide for interposition of the judge as guardian of the law at the proper point and when necessary. There is no question that the judge must remain the ultimate arbiter on the question of obviousness. He or she exercises that role first in exercising the judge's duty of giving proper instructions on the law to the jury before it considers its verdict. The judge exercises control on the question again when presented with a motion for JNOV or new trial. In no sense need the judge abdicate the guardianship role. All that is necessary is that the trial judge's role, as it clearly was here, and ours on appeal, be played within the rules.

(B)(2) Interrogatories

Asserting that submission of general interrogatories (instead of specific interrogatories) was error, leading to a reversal of the roles of judge and jury, RDI centers its attack on interrogatory 1 dealing with obviousness:

> 1. Do you find that the plaintiff has proved by clear and convincing evidence that United States Patent No. 3,837,292 is invalid on the ground of obviousness?

The ten interrogatories submitted to the jury in this case, and the jury's answers, are found in Appendix A to this opinion. As may be seen, all but interrogatories 2, 9, and 10 are substantially identical with interrogatory 1, differing only with respect to the many grounds of invalidity asserted by RDI.

District courts have broad authority and discretion in controlling the conduct of a trial. That authority extends to the form by which juries return verdicts, Fed.R.Civ.P. 49, and will not be interfered with unless an abuse of discretion is shown. *See Hammerquist v. Clarke's Sheet Metal, Inc.*, 658 F.2d 1319, 1322-23, 212 USPQ 481, 483 (9th Cir. 1981), *cert. denied sub nom. Carsonite International Corp. v. Carson Mfg. Co.*, 103 S. Ct. 1499 (1983); *Tights, Inc. v. Acme-McCrary Corp.*, 541 F.2d 1047, 1061, 191 USPQ 305, 314-15 (4th Cir.), *cert. denied sub nom. Kayser-Roth Corp. v. Tights, Inc.*, 429 U.S. 980 (1976). RDI has not shown that the use of the present "interrogatories" constituted an abuse of discretion requiring a new trial in this case.

The challenged "interrogatory" is inartfully labeled as such by the parties. It sets forth a standard of proof ("proved by clear and convincing evidence") in relation to a legal conclusion ("invalid on the ground of obviousness"). Yet legal conclusions are not proved; facts are. Interrogatories, as such, are best employed in seeking answers to factual questions, the answers to which lead to or require a legal conclusion.

That invalidity for obviousness requires proof by clear and convincing evidence of facts establishing obviousness is subject matter not for interrogatories but for instructions on the law guiding the jury enroute to its conclusion on the legal issue submitted to it. Rule 51, Fed.R.Div.P. However, if it be error to label requests for verdicts coupled with elements of instructions on the law as "interrogatories", it must be viewed in light of the entirety of events at trial, and as so viewed it was harmless.

Though labeled as "interrogatories", the ten questions put to the jury were designed to elicit, and were treated by all concerned as having elicited, a ten-part verdict. Because validity was the only issue tried, and the ten interrogatories encompassed each of RDI's numerous defenses, RDI can hardly complain that the jury returned a separate verdict on each of those defenses, instead of returning a general verdict reading, for example, "we find in favor of Stucki" (which of course it could have done absent the ten "interrogatories"). The jury's responses were not special verdicts, because they were not simply "written finding[s] upon each issue of fact". Rule 49(a) Fed.R.Civ.P. Nor was there a single general verdict, *per se*, accompanied by "written answers" to "one or more issues of fact the decision of which is necessary to a verdict". Rule 49(b) Fed.R.Civ.P. Nonetheless, as above indicated, the parties have correctly viewed the jury's ten responses as the equal of a general verdict for Stucki. That the jury spoke specifically with respect to each defense is in this case of benefit to the courts and to the parties.

RDI's primary attack on the interrogatories, which its briefs on occasion call "instructions", centers on the statement that the patent challenger's burden is met by "clear and convincing" evidence, whereas RDI says it is met when a mere "preponderance" is shown. The burden, as above indicated, is to prove *facts* supporting defenses, not, as RDI says, to prove the *legal conclusion*

(patent invalidity) sought by those defenses. This court has said that the standard of proof of facts necessary to support a legal conclusion of invalidity is "clear and convincing". It does not change upon a showing of prior art not considered in the PTO or from defense to defense. *Connell, supra.*

RDI's assertion that the interrogatories resulted in role reversal, in which the judge played the fact-finding role of the jury, is without merit. That the judge, having considered all of the evidence in response to RDI's motions, said he would have made the same findings as those made by the jury does not constitute role reversal. Moreover, as above indicated, when a jury returns a general verdict, the law presumes the existence of fact findings implied from the jury's having reached the verdict. That the jury must make certain findings before it can reach its verdict is, as it was here, made clear in the instructions on the law given the jury. The general verdict thus includes the jury's legal conclusion and a set of implied fact findings, the latter being those necessary to support the legal conclusion encompassed in the verdict.

When, as here, the judge is presented with a motion for JNOV or for new trial and determines whether there is sufficient evidence of record to support the jury's implied findings, that is not role reversal. On the contrary, it is serving precisely the role of the judge under long established procedural rules. *See Panther Pumps & Equipment Co. v. Hydrocraft, Inc.*, 468 F.2d 225, 228, 175 USPQ 577, 579 (7th Cir. 1972), *cert. denied*, 411 U.S. 965 (1973); *May v. American Southwest Waterbed Distributors, Inc.*, 715 F.2d 876, 880, 218 USPQ 433, 437 (5th Cir. 1983).

The role of the trial judge in deciding upon motions for JNOV and new trial, and that of this court on review, are greatly facilitated when the jury has answered a series of factual inquiries in writing. When obviousness is an issue, interrogatories seeking answers in writing to inquiries drawn about those listed in *Graham v. John*

Deere Co., 383 U.S. 1, 148 USPQ 459 (1966), insofar as the evidence adduced at trial relate to those inquiries, should be employed. *Connell, supra*, slip op. at 7, and cases cited therein; *American Hoist and Derrick Company v. Sowa & Sons, Inc.*, slip op. at 18, Nos. 83-555, 83-564 (Fed. Cir. Jan. 1984). Examples modified from those employed in a few actual cases appear in Appendix B to this opinion.

Failure to submit detailed fact interrogatories will not in every case result in the need for a new trial. Rule 49, Fed.R.Civ.P. The practice is nonethless strongly recommended as an appropriate means of guiding a jury, increasing the reliability of its verdict, and facilitating the judicial role following a jury trial.

(B)(3) Instructions

As above indicated, the district court gave the jury extended, detailed, and careful instructions on the law. Those instructions correctly required the jury to make proper findings before reaching its conclusions on legal questions presented to it. The court's instructions specifically required findings on the inquiries set forth in *Graham, supra*, before the jury reached its conclusion on obviousness. The instructions contained no error of law governing the issues at trial that would warrant a new trial.

RDI has made no effort to claim error in any instruction, perhaps for the reason that the very few errors that do appear were favorable to it ("the combination must produce a new and surprising result"; "secondary factors . . . cannot support a finding [sic, holding] that the subject matter is not [sic, would not have been] obvious if your consideration of the three [Graham] factors listed leads to the conclusion that the subject matter is [sic, would have been] obvious"). RDI's briefs include headings asserting error in the instructions, but the text under those headings discusses its foregoing objections to the interrogatories, not to the instructions.

RDI asserts: (1) that Stucki is not entitled to presume that uncited U.S. Patents 1,983,088 to Kiesel and 1,989,433 to Symington were considered in the PTO, solely because they are listed in classes and subclasses searched; and (2) that those two patents and the Holland arrangement are more pertinent than the art cited. Having introduced what it says is more pertinent art, RDI then says it need thereafter "show obviousness" only by a preponderance of the evidence, rather than be required to prove facts supporting obviousness by clear and convincing evidence. That is not the law. *Solder Removal v. ITC,* 582 F.2d 628, 633 n.9 (CCPA 1978); *Richdel v. Sunspool,* No. 83-611 (Fed. Cir. Aug. 3, 1983).

As above indicated, and assuming its art was more pertinent (an unlikely assumption in view of the verdict) RDI was not entitled to an instruction that its burden could be met by a preponderance of the evidence. The presumption of validity is neither weakened nor destroyed where art more pertinent than that considered by the PTO is introduced; the offering party is simply more likely to carry the burden of proving facts clearly and convincingly under those circumstances. *Medtronic, Inc. v. Cardiac Pacemakers, Inc.*, No. 83-820, slip op. at 5-6 (Fed. Cir. Nov. 23, 1983). Similarly, RDI's argument that it was required to prove facts establishing its "failure to set forth the best mode" defense only by a preponderance, because that issue was not before the examiner, is without merit.

RDI included among its plethora of defenses one to which it applied at trial the inappropriate and long ago discredited "late claiming" label. Because Stucki had amended its claims in the course of prosecuting its application, RDI created from that single fact four variously labeled "defenses": (1) that the claims of the '292 patent are designed to encompass RDI's product, and therefore claim an invention different from that originally claimed; (2) that the claims entered by amendment

were never supported by oath or declaration; (3) that RDI had acquired "intervening rights"; and (4) that Stucki was guilty of "late claiming". As the district court correctly recognized, the sole question raised by that single but variously stated defense is whether the claims entered by amendment were supported by the disclosure in Stucki's original application. As clearly set forth at ____ F.Supp. ____, 218 USPQ 631-632, there was ample evidence to support the finding that that question must be answered in the affirmative. RDI's argument that the patent should be held invalid in light of this many-labeled defense is and always was without merit.

Instructions must be viewed in their entirety. A new trial is permissible only when it is clear that error in the instructions as a whole was such as to have misled the jury. In the present case, we conclude that no such error occurred at any point in the instructions given the jury.

(B)(4) Oath or Declaration

As indicated immediately above, there was no basis for RDI's assertion that the patent was invalid for failure to file a separate oath or declaration in support of claims inserted by amendment, those claims being fully supported in the original disclosure. Nor was there basis for RDI's assertion on appeal that the district court erred in failing to declare the patent invalid for lack of a supplemental oath or declaration.

(C) Damages

Judge Broderick thoroughly analyzed the evidence on damages in light of the fifteen factors in *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F.Supp. 1116, 1120, 166 USPQ 235, 238 (S.D.N.Y. 1970), *modified*, 446 F.2d 295, 170 USPQ 369 (2d Cir.), *cert. denied*, 404 U.S. 870 (1971) and approved by his circuit (the Third) in *Trio Process Corp. v. L. Goldstein's Sons, Inc.*, 612 F.2d 1353, 1357, 204 USPQ 881, 883 (3d Cir.), *cert. denied*, 449 U.S. 827 (1980).

A royalty rate of 7.5% was initially suggested in Stucki's January 1975 letter to RDI concerning the possibility of a license, the letter stating that "it is contemplated that the royalty rate will not be in excess of 7½ percent of the net selling price" of a carset.

The district court found that: (1) RDI's pre-tax profit was $72/carset (four snubbers), equalling 16.4% of the sale price; (2) RDI did not make consistent profits until it introduced its infringing snubber; (3) snubber sales increased from $343,200 in 1973 to $5,591,486 by 1980; and (4) although RDI lost $46,856 in 1973 it had, after it began its infringement, a growing taxable annual income reaching $1,292,830 in 1980.

In light of the importance of snubber sales to RDI and the dollar amounts of the selling price and profit, the district court determined that a reasonable royalty was $35/carset, an amount falling in the neighborhood of 7.5% of the snubber's 1974-75 selling price.

Damages of $2,182,986 were awarded based on the sale of 52,183.5 carsets, *supra* note 1, with 6% interest.

Neither party is satisfied with the court's judgment. RDI asserts that the judgment is based on a royalty rate approach that is clearly erroneous because: (i) it is not controlled by existing licenses; (ii) it does not match Stucki's 7.5% offer; (iii) it is not based on the claimed invention; and (iv) it was applied to foreign sales; and (v) it was applied to sales made before receipt of notice. Stucki asserts: (i) it is entitled to lost profits; and (ii) that a 6% interest rate is too low.

RDI's Assertions

i. Existing Licenses

RDI points to three licenses for bolsters and sideframes having royalty rates of either 1% or $1 as evidence of an industry standard. However, three licenses relating to products entirely distinct from the patented product are insufficient here to establish an industry standard. The district court correctly refused to apply the rates of those licenses in the present case.

ii. Stucki's Offer

Based on the 1975-1980 average selling price of $416.19/carset, the royalty of $35/carset set by the district court equates to an 8.4% royalty rate. Though that rate is less than 1% greater than the maximum royalty rate contemplated by Stucki in its January 1975 letter, RDI asserts that the district court was clearly erroneous in establishing it as a reasonable royalty.

The district court considered the royalty rate expressed in Stucki's letter as one factor in reaching its damages determination, noting that the letter itself and the evidence indicated that the letter was not a firm offer, that examination of RDI's records was to have been a prerequisite to a firm offer, that no royalty rate would be accepted if it allowed a licensee to undersell Stucki, and that a minimum royalty of $500,000/year was desired to recover research and development costs. It cannot be said that the difference between 8.4% of the average selling price and a merely "contemplated" 7.5% of the *net* selling price constitutes a sufficient basis for overturning the determination of the district court.

iii. Claimed Invention

Because some claims are in Jepson format, RDI asserts that the claimed invention must be limited to a biasing spring, and that the royalty rate must be based on the $40.00 sale price of four springs. No determination of the effect of the claim preamble was made and no basis appears in the record for limiting the claimed invention to a biasing spring. RDI is presumably aware that claim 10 is drawn to a snubber assembly and is not in Jepson format. The parties sell and customers buy snubber assemblies, not merely biasing springs. RDI's arguments against the application of the royalty rate to the selling price of snubber assemblies are without merit. *Bendix Corp. v. United States*, 676 F.2d 606 (Ct. C1. 1982); *Leesona Corp. v. United States*, 599 F.2d 958, 202 USPQ 424 (Ct. C1. 1979).

iv. Foreign Sales

The award includes royalties for 1,671 carsets sold to foreign customers for installation in truck assemblies in foreign countries. Claim 10 is drawn only to the snubber assembly, not to truck assemblies. RDI admitted infringement of all claims in suit. When it made the 1,671 carsets in this country, it infringed claim 10. Whether those carsets were sold in the U. S. or elsewhere is therefore irrelevant, and no error occurred in including those carsets among the infringing products on which royalty was due.

v. Notice

RDI's mere assertion before us that it did not receive actual notice of the patent until January 13, 1975 does not establish as clearly erroneous the district court's finding that RDI had notice 40 days earlier (December 1, 1974), a finding supported by testimony that marked snubbers were sold soon after marked castings were received in November of 1974.

Stucki's Assertions

i. Lost Profits

Stucki says the district court erred because it required Stucki to prove it would have made all RDI's sales, rather than the percent of those sales Stucki would have made. The district court imposed no such requirement.

The district court stated in its published Memorandum, "[t]here was no evidence in the record upon which this court could base a finding as to the percentage of the plaintiff's infringing sales which would have been made by the defendant in the absence of infringement". _____ F.Supp. _____, 218 UPSQ at 636. It is clear that Stucki was free to prove whatever percentage of RDI sales, up to 100%, for which it was able to submit evidence. One who fails to submit evidence in support of a position cannot be heard on appeal to complain that the trial court failed to find facts upholding that position.

Stucki does attempt before us to rely on this testimony of RDI's expert:

> Q. If RDI were not in the market and if Stucki were able to sell 100 percent of the snubbers sold by RDI through 1980, by what percentage would Stucki's sales have increased?
>
> A. Approximately 68 percent.

In arguing that that testimony established that it would have made at least 68% of RDI's sales, Stucki misconstrues not only our role as an appellate court but the evidence itself. The question presupposes Stucki would have made 100% of RDI's sales and the answer indicates that *that* would have resulted in a 68% increase in *Stucki's* sales. The cited testimony thus provides no support whatever for Stucki's assertion that the testimony indicates Stucki would have made 68% of *RDI's* sales, and cannot support the view that error resides in the district court's statement concerning an absence of proof in the record.

Stucki correctly points out that 35 U.S.C. §284 provides for damages "adequate to compensate" for the infringement and provides for a reasonable royalty only as the floor beneath which a damage award should not fall. Its difficulty here lies in its failure to prove actual damages, leaving the district court with no alternative but that of measuring damages by what would have been a reasonable royalty.

ii. Interest

Lastly, Stucki asserts that a 6% interest rate neither represents the value of money nor adequately compensates Stucki for its loss. 35 U.S.C. §284 provides the court "shall award . . . damages adequate to compensate for the infringement . . . together with interest and costs as fixed by the court. . . ." That language "leaves the court some discretion in awarding prejudgment interest." *General Motors Corp. v. Devex Corp.*, 103 S.Ct.

2058, 2063 (1983); *Lam, Inc. v. Johns-Manville Corp.*, 718 F.2d 1056, 1066, 219 USPQ 670, 676 (Fed. Cir. 1983). Though the court could have selected a higher interest rate, Stucki's mere assertion that 6% is too low does not establish that an abuse of discretion occurred here.

Stucki tells us that in 1980 it stipulated to delay an injunction until decision on appeal, that it learned in the proceedings on damages that the two shareholders of RDI had been and were milking RDI of its assets, that it then filed a motion for an injunction on which the district court had not acted when this appeal was filed, that RDI's two stockholders received from RDI $2,200,000 and $1,000,000, all gained from RDI's infringement during the litigation, that RDI's infringing sales from just before the suit was filed were $19,000,000, with a $9,000,000 gross margin, that Stucki suffered actual damages of more than $7,000,000 over the more than five years from filing to completion of trial while it waited for a decision. The plight of the patent owner in this case may invoke sympathy; it cannot invoke a finding of abuse of discretion.

If Stucki waived an injunction in a mistaken expectation that RDI would remain responsible in damages, that is unfortunate. Nothing of record establishes the extent to which Stucki may have contributed to the five year delay before trial. In all events, the district court conducted a full proceeding on damages, at which Stucki was found not to have established its actual damages under 35 U.S.C. §284. No basis exists therefore for overturning the award of damages and interest made in light of those proceedings.

Further Proceedings

Upon return of this case to the district court, and assuming Stucki's motion for an injunction has not by then been acted upon, we presume that it will be granted at an early date. In determining damages to be

awarded for infringement occurring from the March 28, 1983 final judgment until the grant of the injunction, the rate of interest applicable to those damages is equal to the coupon issue yield of U.S. Treasury bills. 28 U.S.C. §1961 (1982). Stucki's concern for its ability to collect the full amount finally awarded is a matter for presentation to the district court, which may, of course, modify its judgment and is not without power to enforce it.

Costs

The limit lines of lawyering are not always clear. The zenith of zeal was approached if not exceeded by those of RDI's defenses having no true basis in fact or law. Similarly, like RDI, Stucki sought on appeal a retrial of the facts on damages and a *de novo* approach to misconstrued testimony in the face of the district court's express finding, supported on the record, that it had not proved its actual damages. This court is content therefore to leave the parties where it finds them and to provide herewith that each party shall pay its own costs on appeal.

Decision

No prejudicial legal error having been shown to have influenced the jury's verdict, the denial of RDI's motion for JNOV having been eminently correct, the denial of RDI's motion for new trial representing no abuse of discretion, and no error having been shown in Judge Broderick's order awarding $2,182,986 in damages and interest, the final judgment entered on March 28, 1983 is affirmed.

AFFIRMED

APPENDIX A

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF PENNSYLVANIA

Civil Action
No. 76-800

RAILROAD DYNAMICS, INC.
v.
A. STUCKI COMPANY

INTERROGATORIES TO THE JURY

We, the jury in the above captioned case, unanimously find as follows:

Instructions: Answer questions 1, 2 and 3A.

1. Do you find that the plaintiff has proved by clear and convincing evidence that United States Patent No. 3,837,292 is invalid on the ground of obviousness?
   YES_____ NO__X__
2. Do you find that defendant has proved by a preponderance of the evidence that the effective filing date of the invention claimed in United States Patent No. 3,837,292 is August 22, 1969?
   YES__X__ NO_____

3A. Do you find that plaintiff has proved by clear and convincing evidence that United States Patent No. 3,837,292 is invalid on the ground that the invention claimed was known, in public use or on sale more than one year prior to the effective filing date of the patent application?
   YES_____ NO__X__

Instructions: If your answer to question 3A is "No", proceed to question 4 and following questions. If your answer to question 3A is "Yes", answer question 3B and following questions.

3B. Do you find that defendant has proved by clear and convincing evidence that use or sale of the claimed invention was an experimental use?
YES_____ NO_____

4. Do you find that plaintiff has proved by clear and convincing evidence that United States Patent No. 3,837,292 is invalid on the ground that the amendment to the patent application filed on April 18, 1972 required a supplemental oath or declaration in that the amendment contained matter originally shown or described but not substantially embraced in the statement of invention or claim originally presented in the application?
YES_____ NO___X_

5. Do you find that the plaintiff has proved by clear and convincing evidence that United States Patent No. 3,387,292 is invalid for late claiming?
YES_____ NO___X_

6. Do you find that plaintiff has proved by clear and convincing evidence that United States Patent No. 3,837,292 is invalid on the ground that the patent application failed to set forth the best mode contemplated by the inventor for carrying out his invention?
YES_____ NO___X_

7. Do you find that plaintiff has proved by clear and convincing evidence that claims 7 and/or 9 of United States Patent No. 3,837,292 are invalid on the ground they do not particularly point out and distinctly claim the subject matter which the applicant regards as his invention?
YES_____ NO___X_

8. Do you find that plaintiff has proved by clear and convincing evidence that United States Patent No. 3,837,292 is invalid on the ground that the specification of the application does not provide a description such that it would enable one skilled in the art to practice the invention?
YES_____ NO__X__

Instructions: If you have found by any of your answers to prior questions that Patent No. 3,837,292 is invalid, then proceed no further. If, however, you have not found the patent to be invalid, answer questions 9 and 10.

9. Do you find that plaintiff has proved by a preponderance of the evidence that it has acquired intervening rights under United States Patent No. 3,387,292?
YES_____ NO__X__

10. Do you find that defendant has proved by a preponderence of the evidence that plaintiff's infringement of United States Patent No. 3,827,292 was willful?
YES_____ NO__X__

_____
(Signature of Foreperson)

Dated: June 10, 1980.

APPENDIX B

Interrogatories

(MARK YES OR NO)	YES	NO
1. Is the _____ article within the scope and content of the prior art?	☐	☐
2. Did the impedance associated with the low pass filter of the phase locked loop in the _____ Stereo Tuner have substantially equal charge and discharge time constants?	☐	☐
3. Does the _____ Stereo Tuner have constant driving impedance?	☐	☐
4. Does the term "constant driving impedance," as used in U.S. Patent No. _____ ("the reissue patent") teach a person of ordinary skill in the art how much variation that impedance can have and still be "constant"?	☐	☐
5. Was claim 1 of the reissue patent broadened in some respect from its scope in the original patent?	☐	☐
6. Did the inventor listed in the reissue patent act with bad faith or gross negligence when he made the statements of fact to the United States Patent and Trademark Office regarding the operation of the _____ Stereo Tuner?	☐	☐
7. Does the _____ chip have the following elements (which are set forth in each of asserted claims 3, 4, and 5):		
A first filter means?	☐	☐
A second filter means?	☐	☐
A constant driving impedance?	☐	☐

8. With respect to asserted claim 3, does the _____ article disclose:
   a. "a method of attaching a _____ lead of a _____ to a _____" ☐ ☐
   b. "obtaining access to the _____" ☐ ☐
   c. "screwing a free end of the ____ lead into the _____" ☐ ☐
9. Is the level of ordinary skill in the pertinent art that of a _____? ☐ ☐
10. Is the level of ordinary skill in the pertinent art that of the combination of skill and knowledge of a _____ together with the expertise of a _____ engineer having a mechanical or electrical aptitude or engineering degree ☐ ☐

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

Appeal Nos. 83-951
and 83-961

RAILROAD DYNAMICS, INC.,
Appellant/Cross-Appellee,

v.

A. STUCKI COMPANY,
Appellee/Cross-Appellant.

NICHOLS, *Senior Circuit Judge*, concurring in the result.

I concur in the result and join in the portion of the opinion captioned (c) *Damages*. Much, and perhaps all, that is said in the prior parts of the opinion is correct, but I have serious qualms about saying it. The attempt is to have comprehensive guidelines as to all contingencies likely to arise when a jury is asked or allowed to return a general verdict dealing with the issue of obviousness under §103 of the Act. No doubt district courts have a need for these guidelines and it would be a worthy enterprise for one of our able textbook writers. I have qualms about its being attempted by a panel of three judges of a twelve-judge court, even given a panel as distinguished as this one, though but reflected glory in the case of this writer.

The trouble is, it is impossible to foresee all contingencies. In future cases parts of this opinion will be cited, and the response will be made that the words referred to are dicta. Future judges of this court may be struck by our wisdom and wish to follow our words, or they may perceive they are confronted with a problem we did not foresee, and find our words an embarrassment. In the latter event, it cannot now be predicted

whether they will profess themselves bound by our statements, or reject them as nonbinding dicta. The future utility or subsequent career of a dictum is wholly unpredictable, and that is why judges over centuries have avoided dicta, or at least said they were doing so. When a judicial exposition relates to a concrete issue to be decided, the record facts add meaning to the words, and safeguards exist against their being read out of context. With a dictum this is not so, and it may well end up having an effect the judicial author never intended.

Of course, the court should always state the rule of law it relies on, and this rule may cover more than the case before the court. Or dictum may be forensically necessary, for example, to deal with the arguments so commonly urged, predicting imaginary horribles if the court does what it has decided to do. Such forgivable dicta must be carefully limited and hedged.

But if I were to pronounce a dissertation on the subject at hand, I would start with the recent scholarly and comprehensive consideration by the Seventh Circuit, *en banc*, *Roberts* v. *Sears, Roebuck & Co.*, No. 82-1886 (Dec. 21, 1983). I take it this is the "[l]anguage appearing elsewhere" referred to in Part (B)(1). Our own exclusive jurisdiction of certain classes of cases does not require us to follow opinions in such cases by other courts, but it does not require that we ignore them either. In my consideration of this difficult topic, I would grope for light from wherever it might emanate.

The obviousness issue in the instant case is, however, simple, and it can readily be shown that the district judge committed no reversible error. Railroads needed more effective snubbers to deal with car roll and pitch, in view of increasing speeds and load weights, and deteriorating roadbeds. Our inventor perceived that prior art snubbers needlessly attempted to control the entire broad range of car weight from full to empty. The prior art snubbers worked all right, but were not as efficient as the Stucki invention. He contrived a snubber that was

inoperative when the car was empty and engaged only when the car was partially loaded. Railroad Dynamics alleged, however, that the prior art but unpatented Holland device did the same job in almost the same way. Allegedly it too went out of contact at light car loads. The greatest difference between the Holland and Stucki snubbers was not patentably relevant, *i.e.*, the Stucki device in suit was hydraulic and Holland's was not. Stucki offered substantial evidence, however, which the jury could have believed, and in view of the verdict, doubtless did, that the Holland device did not work in the manner asserted by RDI. This is really all there was on the obviousness point. As the Chief Judge says, RDI wanted us to make a finding of our own contrary to the jury's, which we are not at liberty to do. There was no issue as to the jury being inadequately or erroneously instructed as to the obviousness issue or any other point. Surely no federal court, however deluded it may be about patent law in some more difficult areas, would reverse on this merely factual issue.

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF PENNSYLVANIA

Civil Action
No. 76-800

RAILROAD DYNAMICS, INC.,
Plaintiff,

v.

A. STUCKI COMPANY,
Defendant

MEMORANDUM

BRODERICK, *J.* MARCH 25, 1983

This is a declaratory judgment action instituted by plaintiff Railroad Dynamics, Inc. ("RDI") against A. Stucki Company ("Stucki") seeking a declaration that United States Patent Number 3,837,292 (hereinafter "the '292 patent" or the "patent in suit") is invalid. This Court has jurisdiction over the action under 28 U.S.C. §§2201 and 2202 and 28 U.S.C. §1338(a).[1] Stucki, the owner of the patent as assignee of the inventor, Donald

1. At the time this case was tried, appeals from a district court in cases arising under 28 U.S.C. §1338 were heard in the regional courts of appeals and thus an appeal from a decision of this Court would have been heard by the Third Circuit. Jurisdiction of appeals in which the jurisdiction of the district court was based in whole or in part on §1338 is now vested exclusively in the United States Court of Appeals for the Federal Circuit, 28 U.S.C. §1295(a)(1); 28 U.S.C. §171, note (West Supp. June, 1982). Since this Court and the parties have made extensive reference to cases from other Circuits at both the trial and the post-trial stages of this proceeding, and since the relevant law of the Third Circuit appears to be in harmony with the law of other Circuits, and with that of the former Court of Customs and Patent Appeals, we have not considered this change to require any further proceedings or any additions to the already extensive briefing by the parties of the legal issues in the case.

Wiebe, counterclaimed against RDI alleging that the patent was valid and infringed by RDI. RDI has admitted that if the patent is found to be valid, RDI has infringed the patent.

Following a fifteen day trial a jury, in its answers to eleven special interrogatories, found for defendant on all validity issues submitted. The damages portion of the case was then tried to the Court, and judgment was entered on August 26, 1981 in favor of Stucki and against RDI in the amount of $1,960,700.

Plaintiff has moved for judgment notwithstanding the verdict, or, in the alternative, for a new trial, contending that the evidence was insufficient to support the jury's findings and that, as a matter of law, the '292 patent is invalid. RDI contends, as it contended at trial, that the patent is invalid for four reasons: 1) the invention claimed was obvious in view of the prior art at the time of invention, and hence was unpatentable under 35 U.S.C. §103; 2) the patent fails to disclose the best mode of installing and retaining the patented device, rendering the patent invalid under 35 U.S.C. §112; 3) the claims in the patent were filed more than one year after sale and use of the claimed invention, rendering the patent invalid under the late claiming doctrine; and 4) no supplemental oath was filed in support of the claims which ultimately became the claims of the patent, a violation of 37 C.F.R. §1.67 which renders the patent invalid. RDI further contends that even if the patent is valid, it has intervening rights under 35 U.S.C. §252 to continue to make and sell its infringing device because Stucki added the claims which cover RDI's device only after seeing RDI's device in use. Finally, RDI submits that this Court erred in its charge to the jury, making a new trial necessary if judgment notwithstanding the verdict is not granted. For the reasons which follow, we reject all of plaintiff's contentions, and we will deny its motion for judgment notwithstanding the verdict or, in the alternative, for a new trial.

The standards by which a court must decide motions for a new trial and for judgment notwithstanding the verdict have been set forth by this Court as follows:

> [1,2] Motions for a new trial require the exercise of discretion by the Court, whose "duty is essentially to see that there is no miscarriage of justice." 6A *Moore's Federal Practice* ¶59.08[5], at 59-160 (footnote omitted) (2d ed. 1974); *Thomas v. E. J. Korvette, Inc.*, 476 F.2d 471, 474-75 (3d Cir. 1973). The jury's verdict may be set aside only if manifest injustice will result if it were allowed to stand. The Court may not substitute its own judgment for that of the jury merely because the Court may have reached a different conclusion. To grant a motion for judgment n. o. v., the Court must find as a matter of law that the plaintiff failed to adduce sufficient facts to justify the verdict. *Neville Chemical Co. v. Union Carbide Corp.*, 422 F.2d 1205, 1210 (3d Cir.), *cert. denied*, 400 U.S. 826, 91 S.Ct. 51, 27 L.Ed.2d 55 (1970). Such a motion "may be granted only when, without weighing the credibility of the evidence, there can be but one reasonable conclusion as to the proper judgment." 5A *Moore's*, *supra*, ¶50.07[2], at 50-77 (footnote omitted); *Korvette*, *supra*, at 474.

Douglas W. Randall, Inc. v. AFA Protective System, 516 F.Supp. 1122, 1126 (E.D. Pa. 1981), *aff'd* 688 F.2d 820 (3d Cir. 1982).

These standards are applicable to patent cases. Although the question of patent validity, including the determination of the obviousness or non-obviousness of the subject matter of a patent is ultimately a legal one, the determination depends on underlying questions of fact. *Northern Plastics Engineering Co. v. Eddy*, 652 F.2d 333, 336 (3d Cir. 1981); *Tights, Inc. v. Acme-McCrary Corp.*, 541 F.2d 1047, 1060 (4th Cir.) *cert. denied sub nom. Kaiser-Roth Corp. v. Tights, Inc.* 429 U.S.

980 (1976); *Stevenson v. International Trade Commission*, 612 F.2d 546, 549 (CCPA 1979).[2] Where, as here, the jury has found a patent to be non-obvious, and has made other findings which support the validity of the patent, these findings are determinations that the disputed factual questions with respect to the issues of obviousness and validity have been resolved favorably to the patentee. *Dual Manufacturing & Engineering, Inc. v. Burris Industries, Inc.*, 619 F.2d 660, 664 (7th Cir.) (*en banc*) *cert. denied* 449 U.S. 870 (1980). The jury's factual findings may not be overturned if supported by sufficient evidence, viewing the record in the light most favorable to the verdict winner, and giving the verdict winner the benefit of all reasonable inferences. *Black and Decker Manufacturing Co. v. Sears, Roebuck & Co.*, 679 F.2d 1101, 1103 (4th Cir. 1982); *Velo-Bind, Inc. v. Minnesota Mining & Manufacturing Co.*, 647 F.2d 965, 971 (9th Cir.) *cert. denied* 102 S.Ct. 658 (1981).

Much of the background to this case was set forth in this Court's memorandum of August 25, 1981 on the damages issues, and can be summarized as follows:

The patent in suit concerns the spaced placement of a hydraulic shock absorber or "snubber" in the spring group of a railroad freight car, between the bolster and the side frame, held in place by a biasing spring so that it is normally operative only when the car is loaded and is

---

2. Plaintiff contends, now as at trial, that since the question of obviousness is ultimately one of law, it is error to submit the issue in an interrogatory to the jury for its determination, as was done in the trial of this case. This contention has been consistently rejected. *Tights, Inc.*, 547 F.2d at 1061; *Control Components, Inc. v. Valtek, Inc.*, 609 F.2d 763, 766-67 (5th Cir. 1980) *cert. denied* 449 U.S. 1022; *Velo-Bind, Inc. v. Minnesota Mining & Manufacturing Co.*, 647 F.2d 965, 971 (9th Cir.) *cert. denied* 102 S.Ct. 658 (1981); *Panther Pumps & Equipment Co., Inc. v. Hydrocraft, Inc.*, 468 F.2d 225, 228 (7th Cir. 1972) *cert. denied* 411 U.S. 965. *See E. I. DuPont de Nemours & Co. v. Berkley & Co., Inc.* 620 F.2d 1247, 1261 (8th Cir. 1980).

normally inoperative when the car is unloaded.[3] A freight car has four side frames, each of which holds two of the car's eight wheels. A freight car also has two bolsters. A bolster is a metal rod which connects the two side frames at each end of the freight car. The spring group is a group of springs, usually eight to ten in number, located between the wheels in each side frame. Each end of a bolster is attached to and rests upon the springs in the spring group of a side frame. An illustration of the shock absorber in the patented location is given in Figure 1.[4]

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3. Claim 1 of the patent in suit sets forth the invention as follows:

> 1. In a dampened railway truck assembly selectively operable in loaded and unloaded conditions and having a hydraulic snubber apparatus interposed in a spring group intermediate a bolster member and a side frame member, the improvement comprising: means interposed between said snubber apparatus and one of said members to bias said snubber apparatus towards the other of said members; said means being operative to bias said snubber apparatus out of operative engagement with said one of said members when said truck assembly is normally operating in an unloaded condition; and said means and said snubber apparatus being cooperable to initiate hydraulic snubbing by said snubber apparatus substantially only when said railway truck assembly is normally operating in a loaded condition, the bias of said means is partially overcome and said snubber apparatus is in operative engagement with both of said members.

4. In Figure 1, the shock absorber is indicated by Number 132, the bolster by 118, and the side frame by 121. 22 and 23 indicate springs within the spring group.

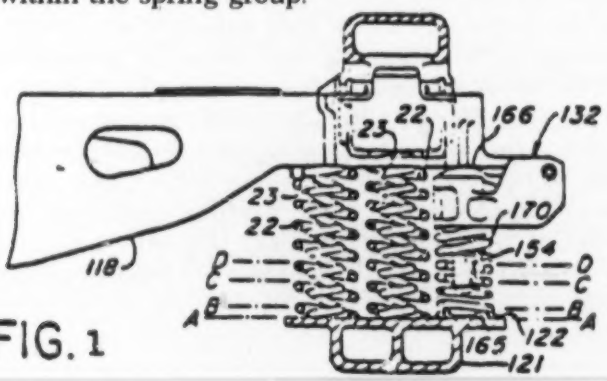

FIG. 1

The springs in the spring group operate in the same manner as springs in an automobile and absorb energy when the freight car is in motion. The energy absorption capacity of the springs is not sufficient, however, to control the movement of many large freight cars, particularly when such cars are being operated at higher speeds or on railroad track that is in poor condition. In such circumstances, these large freight cars begin to rock from side to side, a phenomenon known in the railroad industry as "rock and roll". Primarily on curved track, the rock and roll motion of a freight car can become so severe that the freight car body can be lifted off the center plate upon which it rests, and one or more wheels can actually be lifted off of the track for a fraction of a second. If the wheel does not return to the track, a derailment occurs. Though this problem previously existed in the industry it became particularly acute when 100-ton capacity freight cars, 25-30% larger than previously existing cars, were introduced around 1964. (N.T. 3.109)

In order to prevent derailments due to "rock and roll", the railroad industry developed shock absorbers, or "snubbers", designed to provide added energy absorption capacity to that already supplied by the springs in the spring group. A number of companies developed friction snubbers, designed to dissipate rock and roll energy in the form of heat by bringing two pieces of metal together while the freight car was in motion. In the mid to late 1960's RDI and Stucki manufactured hydraulic snubbers that absorbed excess energy by use of the principles of hydraulics. No snubber completely absorbs all of the energy created by the rock and roll motion of a freight car, but it is claimed that hydraulic snubbers absorb a greater amount of energy than friction snubbers. Only RDI and Stucki manufactured hydraulic snubbers which were accepted in the trade in the late 1960's.

The Stucki hydraulic snubber based on the patent in suit, known as the "HS-6" snubber, is located in the spring group and designed so that it does not become en-

gaged, or begin to absorb energy, until a freight car is loaded with freight. The HS-6 is installed in a spring group by removing one of the outboard springs of the group and replacing it with the HS-6 unit. Since the HS-6 unit is not as long as the distance between the bolster and the side frame, the unit makes use of a "biasing" spring located between the side frame and the snubber which holds the snubber in place and away from the side frame when the freight car is empty. The snubber is pressed into contact with the side frame when the car is loaded and, once pressed into contact, can begin to absorb energy.

The patent in suit, number 3,837,292, was issued to Donald Wiebe on September 24, 1974. It was based on an application [PX-3] filed April 15, 1971. This application was a continuation-in-part of application number 857,274, filed August 22, 1969 [PX-6] ("the parent application"), which was itself a continuation-in-part of application number 709,142, filed February 28, 1968 and later abandoned [PX-7] ("the grandfather application"). Figures 9-12 of the parent application, along with related specifications, were transferred without change to the patent in suit, becoming figures 5-8 of the patent in suit. The remainder of the parent application matured as United States Patent Number 3,595,350, issued to Donald Wiebe on July 27, 1971.

Plaintiff RDI has also marketed an hydraulic snubber placed in the spring group, spaced so that it is engaged only when the freight car is loaded. This snubber is known as the "Control Master" (C/M) snubber. The C/M snubber was designed and built by RDI's president, Stuart Schwam, in three weeks in the fall of 1971. (N.T. 2.38). The C/M snubber is located in the spring group in place of the center spring of the group, and is attached to the side frame and spaced from the bolster by a spring lodged between the top of the snubber and the bolster. RDI has admitted that this device infringes the patent in suit should the patent in suit be found to be valid.

Presumption of Validity

Any analysis of patent validity must begin "with the recognition that a patent is presumed to be valid, and that the burden of establishing invalidity rests on the party asserting it." *Tokyo Shibaura Electric Co., Ltd. v. Zenith Radio Corp.*, 546 F.2d 88, 93 (3d Cir. 1977). This presumption requires invalidity to be demonstrated by strong, clear and convincing proof. *Id. Aluminum Company of America v. Amerola Products Corp.*, 552 F.2d 1020, 1024 (3d Cir. 1977); *Moon v. Cabot Shop, Inc.*, 270 F.2d 539, 541 (9th Cir. 1959); *See* P. Rosenberg, Patent Law Fundamentals §17.05, at 17-27. Moreover, this presumption applies not only to the determination of non-obviousness necessarily implicit in the grant of a patent, but also to those other matters considered by the Patent Office, such as the adequacy of disclosure, and the allowability of additional claims. *Trio Process Corporation v. L. Goldstein's Sons, Inc.*, 461 F.2d 66, 74 (3d Cir.), *cert. denied* 409 U.S. 997 (1972); *Eli Lilly and Co. v. Premo Pharmaceutical Laboratories, Inc.*, 630 F.2d 120, 133-34, (3d Cir.), *cert. denied*, 449 U.S. 1014 (1980), citing *Triax Co. v. Hartman Metal Fabricators, Inc.*, 479 F.2d 951, 956-57 (2d Cir.), *cert. denied* 414 U.S. 1113 (1973); *Baldwin-Lima-Hamilton Corp. v. Tatnall Measuring Systems*, 169 F.Supp. 1, 21 (E.D. Pa. 1958), *aff'd* 268 F.2d 395 (3d Cir.), *cert. denied*, 361 U.S. 894 (1959). With respect to the determination of non-obviousness the presumption is weakened when relevant prior art has not been considered by the Patent Examiner. *Aluminum Corp. of America v. Amerola Products Corp.*, 552 F.2d at 1024. In such a case, "the degree by which the presumption is weakened depends upon a balancing of the pertinence of the newly cited art against the pertinence of the art actually considered by the Patent Office." *Id.* Even should the presumption of validity be weakened, however, it does not shift the burden of persuasion, which "is and always remains upon the

party asserting invalidity, as required by 35 U.S.C. §282." *Stevenson,* 612 F.2d at 551.

Several courts have held that the examiner's search record provides prima facie evidence that he searched all the references in the classes and subclasses noted on the file wrapper as having been searched. References in such subclasses left uncited are presumed to have been regarded by the examiner as less relevant than those cited. *Panduit Corp. v. Burndy Corp.*, 517 F.2d 535, 538 n.2 (7th Cir.) *cert. denied,* 423 U.S. 987 (1075) [sic]; *E. I. du Pont de Nemours & Co. v. Berkley & Co., Inc.*, 620 F.2d at 1267. "A contrary view would destroy the presumption of administrative regularity on which the presumption of validity rests." 620 F.2d at 1267.

Plaintiff contends that the Court was in error in instructing the jury that plaintiff must prove its contentions concerning the invalidity of the patent, which were, of course, contrary to the determinations of the Patent Office, by clear and convincing evidence. Plaintiff's allegation of error is untenable in light of the presumption of validity as discussed in the cases cited above. Plaintiff further contends that the court erred in charging that the plaintiff had the burden of proving obviousness by clear and convincing evidence and that plaintiff's burden should instead have been a preponderance burden, since the evidence showed that relevant prior art had not been considered by the examiner. Specifically, plaintiff relies on four references in the prior art which, plaintiff contends, taken together, render defendant's claimed invention obvious. These references are (1) United States Patent Number 1, 983, 088, issued December 4, 1934 to W. F. Kiesel [PX-27] ("the Kiesel patent"); (2) United States Patent Number 1, 989, 433, issued January 29, 1935 to T. H. Symington [PX-60] ("the Symington patent"); (3) a description of an hydraulic shock absorber manufactured by the Monroe Auto Equipment Company, designed to replace one spring in each spring group, which description appeared in the

March 3, 1945 issue of Railway Age at page 421, [PX-68] ("the Monroe snubber"); and (4) a spring group arrangement manufactured and sold by the Holland company, in which two "E-2" Holland volute springs, which operated as friction snubbers, were used with eight "D-5" springs.[5] This arrangement (hereinafter "the Holland snubber") is illustrated in a drawing dated February 8, 1966, reproduced as Figure 2 [PX-78]. An "adapter spring" was used in this arrangement to prevent the Holland snubber from falling out of the spring nest.

The question of whether the patents cited by RDI were more pertinent to the determination of obviousness than the prior art cited by the Examiner was properly one for the jury. *Tights, Inc. v. Acme-McCrary Corp.*, 541 F.2d at 1047; *Aluminum Corporation of America v. Amerola Products Corp.*, 552 F.2d at 1025 n.8. The jury in this case was properly instructed, in accordance with the *Alcoa* and *du Pont* cases cited above, as to the standards for making this determination and as to the effect on the presumption of validity of a determination that more relevant prior art had not been cited (N.T. 14.122-23). There is no basis for plaintiff's allegation of error.

Moreover, we find that there was sufficient evidence in the record for the jury to have determined that the presumption of validity was not weakened in this case because the material considered by the Patent Office effectively incorporated the significant prior art. *See Northern Plastics v. Eddy*, 652 F.2d at 338-39 n.13. The Kiesel patent and the Symington patent are both classi-

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5. The E-2 volute snubber has a "free height", or uncompressed height, of approximately 9⅛", and a solid or fully compressed height of $6^{9}/_{16}$". Thus, its "travel" is 2½". The D-5 spring has a free height of about 10¼" and a solid height of $6^{9}/_{16}$". Thus, its "travel" is $3^{11}/_{16}$". The E-2 volute snubber was later known as a D-3 volute snubber, the change in terminology being necessary for consistency with the standard dimensions and terminology of the American Association of Railroads (AAR). (N.T. 2.63, 2.101, 8.91).

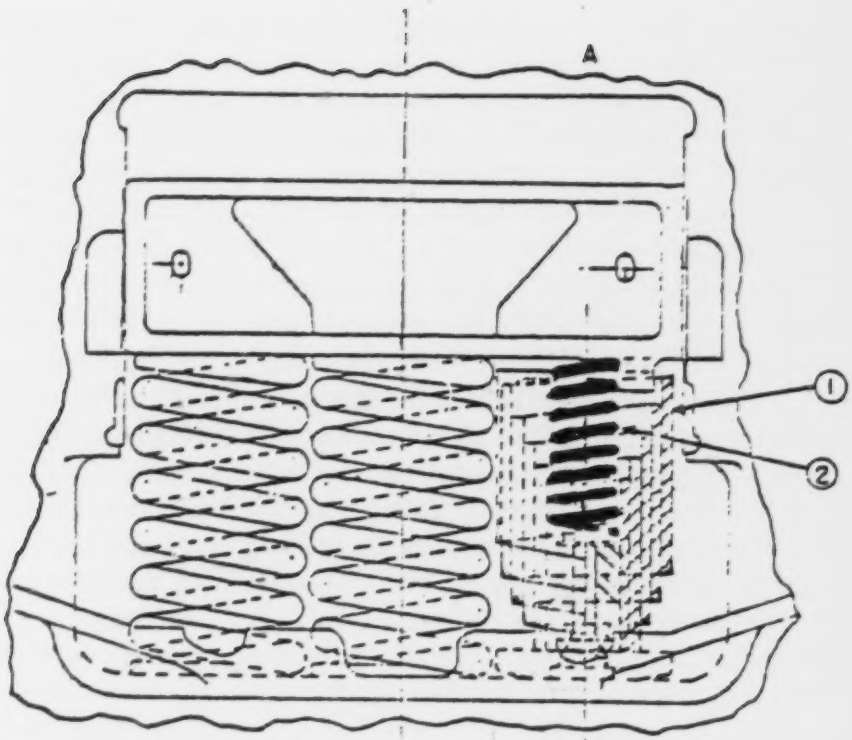

FIGURE 2

HOLLAND COMPANY
CHICAGO, ILL.

SPRING GROUP ARRANGEMENT
HOLLAND VOLUTE SNUBBER SPRING,
STYLE E-2, TO L&N R.R. 80 TON
HOPPERS, NOS 167000-167999

DATE 2/8/66 DRAWING NO B-333 ISSUE

BEST AVAILABLE COPY

fied in subclasses cited by the Examiner. The Monroe snubber's teaching of placement of a hydraulic snubber in a spring group is substantially the teaching of United States Patent Number 3, 464, 366 granted to O. E. Seay on September 2, 1969 ("the Seay patent"). The Seay patent was cited by the Examiner. The teaching of the Holland snubber was a hotly contested issue at trial, and the jury could well have concluded that it taught no more than the art cited by the Examiner. The evidence showed, for example, that the Seay patent cited by the Examiner included a return spring which was similar in function to the adapter spring in the Holland arrangement (N.T. 12.5, 12.88).[6] Finally, our own evaluation of the evidence adduced on the question of obviousness, discussed below, leads to the conclusion that it does not support a finding of obviousness even by a preponderance of the evidence.

OBVIOUSNESS

35 U.S.C. §103 provides that a patent may not be obtained if the claimed invention would have been obvious to a person of ordinary skill in the art to which the subject matter of the invention pertains.[7]

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6. Since the statutory presumption of validity is "heightened by a showing that the prior art was adequately considered," *Shackelton v. J. Kaufman Iron Works, Inc.*, 689 F.2d 334, 339 n.3 (2d Cir. 1982), the instruction given may in fact have been less generous to the defendant than that to which it was entitled.

7. 35 U.S.C. §103 reads as follows:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The standards for evaluating obviousness were set forth by the Supreme Court in *Graham v. John Deere Co.*, 383 U.S. 1, 17-18, 86 S.Ct. 684, 693-94 (1966), as follows:

> Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness of nonobviousness, these inquiries may have relevancy.

Under the holdings of the Third Circuit and at least four other circuits, combination patents, i.e., patents on inventions which combine known elements, are analyzed in light of the factors set forth in *Graham*, and not held to any higher standard of nonobviousness. *Rengo Company, Ltd. v. Molins Machine Co., Ltd.*, 657 F.2d 535, 544 & n.18 (3d Cir. 1981), *cert. denied*, 454 U.S. 1055 (1982); *Plastic Container Corp. v. Continental Plastics*, 607 F.2d 885, 904-05 (10th Cir. 1979); *Champion Spark Plug Co. v. Gyromat Corp.*, 603 F.2d 361, 372 (2d Cir. 1979); *Republic Indus., Inc. v. Schlage Lock Co.*, 592 F.2d 963, 967-72 (7th Cir. 1979); *Nickola v. Peterson*, 580 F.2d 898, 912 n.22 (6th Cir. 1978). *See*, L. Pretty, A Forecast of CAFC Holdings on Issues Unsettled in the Circuits Based on CCPA Precedents, 10 APLA Journal 270, 271-72 (1982) (predicting that the Federal Circuit will reject "synergy" as a requirement for patentability of combination patents).

Our primary inquiry under *Graham* concerns (1) the scope and content of the pertinent prior art; (2) the

difference between the prior art and the claims at issue; and (3) the level of ordinary skill in the pertinent art. We have set forth above the references in the prior art upon which plaintiff has placed its primary reliance in seeking a declaration of the invalidity of the patent in suit. The testimony at trial showed that the relevant level of skill was at least that possessed by an "ordinary engineer" with knowledge of mechanical design principles and vibration theory equivalent to that of a college graduate, and with some experience in the railroad industry. (N.T. 2.49, 3.36, 3.72, 4.102) The relevant level of skill is that possessed by a designer, not a user, of the railroad suspension devices here in issue. *In re Nalbandian*, 661 F.2d 1214, 1216 (CCPA 1981) (citing similar holdings from the Second, Third, Tenth and District of Columbia Circuits).

The testimony at trial showed several significant differences between the prior art relied upon by the plaintiffs in seeking to invalidate the patent due to obviousness and the subject matter of the patent in suit, and established that the prior art did not embody the primary advantages of the patent in suit.

Of the prior art devices cited, only the Holland snubber included a spring in a location between the snubbing device and the bolster or side frame. Testimony at trial showed that the Holland "adapter spring" was designed to, and operated to, retain the snubber in the spring group, and not to keep the snubber out of operative engagement with the bolster in light loads.[8] (N.T. 12.74, 12.19-20). The biasing spring of the patent in suit was designed, and operated, however, to accommodate all of the complex motions associated with the "rock and roll" of a freight car, lateral as well as axial.

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8. Testimony at trial also showed that a spring on the Monroe snubber had a similar purpose (N.T. 11.142). The Monroe snubber was designed to be in constant contact with the bolster and side frame.

(N.T. 11.142-43, 12.19-21, 12.71-72). There was a great deal of testimony concerning the tendency of the Holland snubber to "trap" or become stuck in a compressed position (N.T. 2.151-52, 3.175-76). Under these circumstances a method for retaining the Holland snubber in the spring group and for urging its reextension into its normal operating position was necessary. This was the function primarily performed by the Holland adapter spring (N.T. 2.156, 3.117, 175, 11.142).

There was also testimony showing that the Holland arrangement did not maintain a constant and uniform spacing of the snubber from the bolster. Testimony was given showing that the Holland device, in normal operating conditions, was in constant contact with the bolster member, so much so that the top of the volute coil actually "Brinelled", or wore groves, of as much as a quarter of an inch into the bottom of the bolster. (N.T. 2.166-67, 11.140). The Holland spring did not make contact with the top of the volute coil in order to prevent this undesirable effect. Instead, it was connected to the bushing around a nut in the interior of the snubber device (N.T. 3.181, 9.11-12). While this placement may have aided in the reextension of a "trapped" snubber, it did not maintain the snubber out of operative engagement with the bolster.

The biasing spring of the patent in suit, by contrast, does respond to lateral as well as axial movement, enabling the device to achieve its goal of maintaining the snubber out of operative engagement with the bolster or side frame in light loads. Moreover, this biasing spring is able to maintain a more uniform spacing between the snubber and the bolster or side frame. The problems of "trapping" and of "Brinelling", with the resultant wear on the bolster or side frame, are thus largely overcome.

Both the Kiesel patent and the Symington patent, while indicating the desirability of spacing between a snubber and a side frame or bolster under light load conditions, did not provide effective means to accomplish

this goal, as did the patent in suit. There was, in fact, testimony at trial that neither snubber would have been able to function in order to achieve the results each claimed or sought. (N.T. 9.39, 11.124, 129-30). In addition, the Kiesel and Symington devices were designed for use on cars with "plain" side bearing journals, rather than on cars with "roller" side bearing journals. (N.T. 8.75-76, 9.35-36). Neither device was, therefore, designed to control nor, according to the testimony, could have effectively controlled, the greater degree of lateral movement, allowed in the more modern "roller" journal cars, which lateral movement was considered to be a factor in creating "rock and roll". (N.T. 9.35, 41, 44-45, 11.123-24). All of these differences between the prior art and the patent in suit show that the patented device represented a significant advance in the attempts of the designers of railroad suspension equipment to control the "rock and roll" problem, and did not merely apply "knowledge clearly present in the prior art." *Cf. In re Sheckler,* 438 F.2d 999, 1001 (CCPA 1971).

As stated above, the fact that a claimed invention combines elements known in the prior art does not mean that in determining obviousness we should hold it to a standard different from that which *Graham* mandates.

> Of course, virtually all mechanical inventions are new combinations of old elements. The pertinent question is not whether each element was known or obvious, but whether, considering the invention as a whole, it would have been obvious to combine the elements in the claimed relationship, and a court may look to such evidence of unobviousness as new and advantageous results achieved by the claimed invention, industry acceptance, commercial success, and copying by others.

Square Liner 360°, Inc. v. Chisum, 691 F.2d 362, 369 (8th Cir. 1982) (citations omitted). The elements of the claimed invention in the '292 patent had never pre-

viously been combined in the manner set forth in the patent. The biasing spring in particular performs a function substantially different from that of previous springs used in snubber devices, resulting in advantages in the efficiency and performance of the snubber. As a result, the device is non-obvious and patentable. *See Trio Process Corp. v. L. Goldstein's Sons, Inc.*, 461 F.2d 66, 73 (3d Cir. 1972).

Patentability is not defeated because the claimed invention is embodied in a snubber which serves the same purpose as did previous snubbers. *Jamesbury Corp. v. Litton Industrial Products, Inc.*, 586 F.2d 917, 922 (2d Cir. 1978). Invention is exhibited in the cooperation of the elements of the patented device in a new and useful way to accomplish an improved result, enhancing its usefulness, *Id. See Williams Manufacturing Co., v. United Shoe Machinery Corp.*, 316 U.S. 364, 368, 62 S.Ct. 1179, 1181 (1942). As the former Court of Customs and Patent Appeals noted "patents are and should be granted to later inventors upon unobvious improvements. Indeed, encouragement of improvements on prior inventions is a major contribution of the patent system and the vast majority of patents are issued on improvements." *In re Hogan*, 559 F.2d 595, 606 (1977).

Plaintiffs have argued vigorously that the ineffectiveness of prior art devices, or even their unworkability, does not preclude their consideration as relevant prior art which renders the claimed invention obvious. While unworkable devices can be considered as part of the prior art, their practical ineffectiveness does provide an indication of the nonobviousness of a successful and workable device. *Ling-Temco-Vought, Inc. v. Kollsman Instrument Corp.*, 372 F.2d 263 (2d Cir. 1967); *Panduit Corp. v. Stahlin Bros. Fibre Works, Inc.*, 298 F.Supp. 435, 446 (W.D. Mich. 1969), *aff'd* 430 F.2d 221 (6th Cir. 1970), *cert. denied* 401 U.S. 939 (1971). *See Sutter Products Co. v. Pettibone Mulliken Corp.*, 428 F.2d 639, 646-47 (7th Cir. 1970); *Azoplate Corporation v.*

Silverlith, Inc., 367 F.Supp. 711, 721-22 (D. Del. 1973), *aff'd.* 506 F.2d 1050 (3d Cir. 1974), *cert. denied* 421 U.S. 914 (1975) ("the inherent inoperativeness of the printing plates as disclosed in the French patent and the explicit ineffectiveness of the diazo compounds of Zahn militate against a conclusion of obviousness"). Neither the Kiesel reference nor the Symington reference was ever reduced to practice, and serious doubts were expressed at trial as to whether either would have operated as an effective snubber. Both of these factors reduce the weight to be given to these references in determining obviousness.

It should also be noted that both the Kiesel and the Symington references were over thirty years old at the time of the claimed invention, and designed for cars of different configuration than those having the most severe "rock and roll" problems in the 1960's. This also reduces the degree to which the claimed invention can be considered obvious in view of these references. *See General Battery Corp. v. Gould, Inc.*, 545 F.Supp. 731, 752 (D. Del. 1982); *Wilden Pump and Engineering Co. v. Pressed & Welded Products Co.*, 199 U.S.P.Q. 390, 399 (N.D. Cal. 1978), *aff'd in part, rev'd in part on other grounds*, 655 F.2d 984 (9th Cir. 1981).

The determination that the subject matter of the patent in suit was not obvious in light of the relevant prior art is further buttressed by the fact that the prior art as it developed did not lead towards the spaced structure crucial to the claimed invention. During and even after the time of the claimed invention, devices were being developed, and patented, which rejected a spaced configuration. The opinion of most in the industry was, in fact, that a spaced configuration would not be effective in controlling "rock and roll". (N.T. 10.73, 77-78, 12.108-09). Significantly, the Holland Company, which designed and manufactured the prior art device on which plaintiff most heavily relies in arguing obviousness, developed and sold, in 1965 and 1966, a "D-5" vo-

lute snubber, which was designed to maintain constant contact with the bolster and side frame at all times, and did in fact do so. (N.T. 2.124-25, 4.20, 4.41). "When prior art teaches away from the methods used in a patent, it is relevant and persuasive evidence of the nonobviousness of the patented matter." *General Battery Corp. v. Gould, Inc.*, 545 F.Supp. at 753, *citing Tights, Inc. v. Acme-McCrary Corp.*, 541 F.2d at 1059 ("the fact that the defendants' prior art references lead away from [the patent in suit] and that even unusually skilled artisans in the field corroborated the negative teachings, is both relevant and persuasive as to the question of non-obviousness").

The ability of the Holland E-2 snubber arrangement to teach the spaced configuration of the patent in suit was also impaired by the fact that its operative embodiments did not maintain uniform spacing between the snubber and the bolster or side frame, and that, in fact, the Holland E-2 device was consistently in contact with these members. (N.T. 8.152-53, 10.105, 11.136-40, 12.20). One of plaintiff 's expert witnesses, in fact, was shown at trial to have submitted a patent application in 1971 in which he averred that "[h]eretofore damping type volute roll absorber[s] of the type shown in [the] patent have been designed with the intention that they maintain contact with the bolster throughout its entire range of movement." (2.147). This further undermines plaintiff 's contention that the subject matter of the patent in suit was obvious in light of the Holland arrangement.

Secondary Considerations As to Obviousness

The so-called "secondary considerations" with respect to obviousness — commercial success, long-felt but unsolved needs, failure of others, and so forth — are frequently considered by courts in arriving at a conclusion as to the obviousness or non-obviousness of a patent. These considerations are readily susceptible of judi-

cial treatment, and also help to prevent a court from slipping into the use of hindsight, and from improperly reading into the prior art the teachings of the invention in issue. *Graham v. John Deere,* 383 U.S. at 36, 86 S.Ct. at 703. While *Graham* itself indicated that these secondary considerations cannot alone be dispositive on the issue of obviousness, the considerations have considerable value as "real-life indicia" of validity. *Jacobson Brothers, Inc. vs. United States,* 184 U.S.P.Q. 181, 185 (Trial Div. 1974), *aff'd* 185 U.S.P.Q. 168 (Ct.Cl. 1975). The recently created Federal Circuit has stated that evidence as to secondary considerations, when properly presented, must always be considered in connection with the determination of obviousness. *In re Sernaker,* No. 82-579, slip.op. at 18 (Fed. Cir. February 28, 1983); *See Stevenson v. International Trade Commission,* 612 F.2d at 553; *Shackelton v. J. Kaufman Iron Works, Inc.,* 689 F.2d 334, 340 (2d Cir. 1982) (evidence favorable to the patentee on secondary considerations "strongly suggests that the combination created . . . was not obvious to others working in the same field").

The evidence at trial showed, without contradiction, that the snubber embodying the claimed invention was commercially successful and accepted by the industry as a desirable, useful and beneficial device. (N.T. 2.55, 2.179). Clearly, the inference that a device of such value would have appeared earlier, were it in fact obvious, is permissible in this case. *See In re Sernaker,* slip.op. at 21 (Davis, J., concurring) (unrebutted evidence of commercial success "decisive" in showing non-obviousness); *Black and Decker Manufacturing Company v. Sears, Roebuck & Co.,* 679 F.2d 1101, 1104 (4th Cir. 1982) (tremendous commercial success of patented device makes it "highly unlikely" that the device would have been obvious to a person of ordinary skill in the art when patented). Further, the testimony as to the advantage of the spaced structure with the biasing spring easily sup-

ports the inference that the claimed invention itself was responsibile for this success.

There was also ample evidence in the record to show that the claimed invention filled a long-felt need in the industry for an efficient, effective and relatively low-cost device capable of controlling the rock and roll movement of large freight cars. The industry had devoted considerable resources in the five years preceeding this invention in the attempt to solve the rock and roll problem. (N.T. 4.154, 10.78). Defendant's expert witness, Mr. Tack, who had been employed by one of the defendant's competitors, testified for example, that his employer had spent about a quarter of a million dollars per year over a five to six year period in research efforts to develop a device capable of controlling rock and roll, without developing a successful device. (N.T. 11.146-52). In light of the demonstrated failure of those in the field to obtain a solution to the problem, despite their knowledge of the problem and their strenuous attempts to solve it, it would be most difficult to conclude that the solution embodied in the claimed invention was obvious to those in the field at the time the invention was made. *See Reiner v. I. Leon Co.*, 285 F.2d 501, 504 (2d Cir. 1960), *cert. denied*, 366 U.S. 929 (1961). This invention was clearly not one of those which "do not cost much in time or other resources to make because existing products or processes embody most of the information that constitutes the invention", and which hence may not justify the grant of a patent monopoly. *Cf. Roberts v. Sears, Roebuck and Company*, 697 F.2d 796, 797 (7th Cir. 1983). Most of the devices which those in the industry developed to control the rock and roll problem, including those of the plaintiff's president, were eventually patented, and the amount of inventive activity within this industry could well have been spurred by the prospect of patent protection for the device that would ultimately prove successful in controlling the problem. A failure to uphold the validity of a patent obtained under

such circumstances could discourage the future commitment of resources to inventive activities.

Evidence that an infringing device was copied from the patented device may also provide evidence of the non-obviousness of the patented device. *Square Liner 360° v. Chisum*, 691 F.2d at 369. In the present case there was evidence supporting an inference that the infringing RDI "Control/Master" snubber had been copied from the patented device. The designer of the infringing device, plaintiff's president, had seen the patented snubber tested in June, 1969, and had the opportunity to observe how it was mounted. (N.T. 2.41). The infringing device was designed in a very short period of time, in late 1971. At about the same time, plaintiff came into possession of two drawings, showing in some detail the configuration of the patented device. [PX-55] (N.T. 11.99-100). Given the substantial amounts of time and money which defendant and other manufacturers had expended in an attempt to find a device which would control the rock and roll problem, the jury could have rejected the testimony of plaintiff's president that, having seen the defendant's snubber arrangement, he was able to design the infringing device in only three weeks without copying the patented device.

For all of the above reasons, it is this Court's finding that, had it been sitting in this case without a jury, we would have found that plaintiff failed to produce sufficient evidence to support its contention that the claimed invention would have been obvious to a person of ordinary skill in the relevant art at the time it was made, in light of the pertinent prior art. By the same token, the Court finds that the jury's determination that the plaintiff in this case failed to present sufficient evidence to show that the claimed invention was obvious is supported by the evidence. The jury was asked in interrogatory number 1:

> 1. Do you find that the plaintiff has proved by clear and convincing evidence that the United

States Patent No. 3,837,292 is invalid on the ground of obviousness?

The jury answered no. This Court must reject the motion of the plaintiff to set aside this finding as not supported by the weight of the evidence, and we also deny plaintiff's motion requesting that this Court find, as a matter of law, that the '292 patent is invalid on the ground of obviousness.

Best Mode

Plaintiff also contends that the patent in suit is invalid under 35 U.S.C. §112 because it does not disclose that lugs and pins are necessary to hold the snubber in place in the claimed location, although the inventor was aware of the need for such retaining devices. Section 112 provides in pertinent part:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

As the statute makes clear, the "best mode" which must be disclosed is the best mode known to the inventor. *Trio Process Corp. v. L. Goldstein's Sons*, 461 F.2d at 74. In the present case, the inventor testified that he considered the representation disclosed in the patent to be the "best mode" of carrying out his invention, and that the problem of retaining the snubber within the spring group was best dealt with by redesigning the spring. (N.T. 10.33-37). Crediting this testimony, as we are bound to do in light of the jury's finding, we find that it alone adequately supports the jury's conclusion that the patent was not invalid for failure to disclose the "best mode".

Even assuming that the use of retaining pins did constitute a superior means of practicing the invention, and that these means were known to the inventor, it does not follow that the failure to disclose these means in this case invalidates the patent. The adequacy of disclosure under §112 must be evaluated with respect to persons skilled in the art, and patent specifications will not be required to be so detailed as "production specifications." *Trio Process*, 461 F.2d at 74. The evidence in this case showed that both the problem of non-retention of the snubber and its solution were readily apparent to both designers and users of the device, and that neither required extensive experimentation or inventive effort. As the Supreme Court noted in construing a predecessor to §112:

> If a mechanical engineer invents an improvement on any of the appendages of a steam-engine, he is not obliged, in order to make himself understood, to describe the engine, nor the particular appendage to which the improvement refers, nor its mode of connection with the principal machine. These are already familiar to others skilled in that kind of machinery. He may begin at the point where his invention begins, and describe what he has made that is new, and what it replaces of the old. That which is common and well known is as if it were written out in the patent and delineated in the drawings.

Loom Co. v. Higgins, 105 U.S. 580, 585-86 (1882). There is no question in this case but that the use of pins and lugs to hold a snubber was well-known; a similar method appears to have been used to insure the retention of Holland E-2 snubbers when used with D-5 springs. (N.T. 2.112-13). Under such circumstances, failure to disclose this method of retention does not violate §112. *See Rengo Company, Ltd. v. Molins Machine Co.*, 657 F.2d 535, 549-50 (3d Cir. 1981), *cert. denied*,

454 U.S. 1055 (1982); *Anchor Plastics Company, Inc. v. Dynex Industrial Plastics Corp.*, 363 F.Supp. 582, 602 (D.N.J. 1973), *aff'd* 492 F.2d 1238 (3d Cir. 1974); *In re Sherwood*, 613 F.2d 809, 817, (C.C.P.A. 1980) *cert. denied*, 450 U.S. 994 (1981) ("there would seem to be no cogent reason to require disclosure of the menial tools known to all who practice this art.") Finally, we note that the former Court of Customs and Patent Appeals recently set forth a standard for testing the adequacy of disclosure under §112 which focuses, in effect, on the good faith of the inventor in making the disclosure. Under this standard, the evidence, in order to support a best mode rejection, must "tend to show that the *quality* of an applicant's best mode disclosure is so poor as to effectively result in concealment." *In re Sherwood*, 613 F.2d at 816 (emphasis in original). In this case there is no evidence that the retention problem or its solution "was intentionally left out of the patent disclosures". *See General Motors Corp. v. United States International Trade Commission*, 687 F.2d 476, 483 (C.C.P.A. 1982). As stated above, the jury appears to have credited the inventor's testimony that he intended to disclose the best mode, and even plaintiff's memorandum in support of its motion for judgment notwithstanding the verdict, at 26, characterizes defendant's alleged failure to disclose the best mode as the result of carelessness, not as the result of concealment. For all of these reasons, we find that the jury's answer of "no" to interrogatory No. 6, which reads:

> 6. Do you find that plaintiff has proved by clear and convincing evidence that United States Patent No. 3,837,292 is invalid on the ground that the patent application failed to set forth the best mode contemplated by the inventor for carrying out his invention?

was supported more than sufficiently by the evidence and that the patent in suit is not invalid under 35 U.S.C. §112 for failure to disclose the best mode.

Late Claiming, Failure to File A Supplementary Oath, and Intervening Rights

Plaintiff contends, now as at trial, that the filing on April 14, 1972, more than one year after sale of the patented device, of the claims which form the basis for plaintiff's infringement, invalidates the patent under the "late claiming" doctrine, as enunciated in *Muncie Gear Works, Inc. v. Outboard Marine & Mfg. Co.*, 315 U.S. 759, 62 S.Ct. 865 (1942) and *Kahn v. Dynamics Corp. of America*, 508 F.2d 939 (2d Cir. 1974), *cert. denied*, 421 U.S. 930 (1975). Plaintiff also contends that the added claims constituted new matter for which a supplemental oath or declaration was required under Rule 67 of the Rules of Practice in Patent Cases, 37 C.F.R. §1.67.[9] Since no supplemental oath was filed, plaintiffs contend, the patent is invalid. Finally, plaintiff contends that even if the patent is valid, plaintiff acquired intervening rights to continue the manufacture and sale of its infringing

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9. 37 C.F.R. §1.67 provides:

> When an applicant presents a claim for matter originally shown or described but not substantially embraced in the statement of invention or claim originally presented, he shall file a supplemental oath or declaration to the effect that the subject matter of the proposed amendment was part of his invention: That he does not know and does not believe that the same was ever known or used in the United States before his invention or discovery thereof, or patented or described in any printed publication in any country before his invention or discovery thereof, or more than one year before his application, or in public use or on sale in the United States for more than one year before the date of his application, that said invention has not been patented or made the subject of an inventor's certificate in any foreign country prior to the date of his application in this country on an application filed by himself or his legal representatives or assigns more than twelve months prior to this application in the Unites States, and has not been abandoned. Such supplemental oath or declaration should accompany and properly identify the proposed amendment, otherwise the proposed amendment may be refused consideration.

device. The jury found that the patent in suit was entitled to an effective filing date of August 22, 1969, and that the patent was not invalid under the "late claiming" doctrine. The jury also found that the patent was not invalid for failure to file a supplemental oath and that plaintiff did not acquire intervening rights to continue the manufacture and sale of the infringing device. The evidence presented at trial was more than sufficient to support these findings.

The claims in the patent in suit which plaintiff has infringed were not a part of the parent application of August 22, 1969 [PX-6] nor were they a part of the application for the patent in suit as originally filed on April 15, 1971 [PX-3]. They were added on April 14, 1972. The original claims, which were directed to the internal construction of the snubber, were transferred to a separate continuation-in-part application and later abandoned. The drawings and specifications of the patent as issued were contained in the parent application and transferred unchanged to the application for the patent in suit: only the claims were changed.

The *Kahn* case does support plaintiff's contention that the "late claiming doctrine" invalidates the claims of the patent in suit. Every other circuit court which has considered this issue, however, including the former Court of Customs and Patent Appeals, has adopted a contrary view of the import of *Muncie Gear*, holding that a "late claiming" argument, properly understood, raises only the question of whether the application, as of its effective filing date, provided adequate support in its *disclosure* for the later-submitted claims. *Westphal v. Fawzi*, 666 F.2d 575, 212 U.S.P.Q. 321 (C.C.P.A. 1981); *Faulkner v. Baldwin Piano & Organ Co.*, 561 F.2d 677, 195 U.S.P.Q. 410 (7th Cir. 1977), *cert. denied*, 435 U.S. 905, 98 S.Ct. 1450, 55 L.Ed. 2d 495 (1978); *Cardinal of Adrian, Inc. v. Peerless Wood Products, Inc.*, 515 F.2d 535, 185 U.S.P.Q. 712 (6th Cir. 1975); *Price v. Lake Sales Supply R. M., Inc.*, 510 F.2d 388, 183 U.S.P.Q. 519

(10th Cir. 1974); *Locklin v. Switzer Brothers, Inc.*, 299 F.2d 160, 131 U.S.P.Q. 294 (9th Cir. 1961), *cert. denied*, 369 U.S. 861, 82 S.Ct. 950, 8 L.Ed.2d 18 (1962); *Chicopee Manufacturing Corp. v. Kendall Co.*, 288 F.2d 719, 129 U.S.P.Q. 90 (4th Cir.), *cert. denied*, 368 U.S. 825, 82 S.Ct.44, 7 L.Ed.2d 29 (1961). *See Eli Lilly and Co. vs. Premo Pharmaceutical Laboratories*, 630 F.2d at 133-34.

We adopt this view. The issue of whether the claims as ultimately issued were identical to the claims of the parent application as originally filed is irrelevant under this view of the "late claiming" doctrine. The sole question is whether these claims were supported by an adequate disclosure in the original application. If so, they are entitled to the effective date of the prior application under 35 U.S.C. §120. *Triax Co. v. Hartman Metal Fabricators, Inc.*, 479 F.2d 951, 957 (2d Cir. 1973), *cert denied* 414 U.S. 1113 (1973).

Similarly, the question of whether the added claims constituted new matter for which a supplemental oath was required also depends solely on whether the claims are supported by the disclosure in the original application. *In re Rasmussen*, 650 F.2d 1212 (C.C.P.A. 1981). As the Court stated in *Rasmussen*, "Disclosure is that which is taught, not that which is claimed. An applicant is entitled to claims as broad as the prior art and his disclosure will allow." 650 F.2d at 1214. Finally, the fact that a claim "may be broader than the specific embodiment disclosed in a specification is in itself of no moment." 650 F.2d at 1215. The claims, not the drawings, define the scope on the patent, and every conceivable embodiment need not be disclosed in the drawings, *Maxon v. Maxon Construction Co.*, 395 F.2d 330, 334-35 (6th Cir. 1968); *see Continental Paper Bag Co. v. Eastern Paper Bag Co.*, 210 U.S. 405, 418-19 (1908).

We find that the evidence in this case shows that the disclosure in the parent application of August, 1969 was adequate to support the claims filed in April, 1972,

which became the claims of the patent as issued in August, 1974. First, the illustrations of the claimed invention, Figures 5-8 of the patent in suit, appeared in identical form as Figures 9-12 of the parent application. Figure 8 in particular clearly shows the spacing of the snubber from the side frame, the biasing spring, and its positioning, which form the basis of the claimed invention. As the cases cited above demonstrate, the fact that there is no drawing also showing a snubber spaced from the bolster does not serve to invalidate a claim based on such spacing. As plaintiff's expert Dr. Paul testified, given the disclosure of spacing from the side frame, the notion of spacing from the bolster is obvious. (N.T. 3.99-3.100). These illustrations thus provide support for the claims later added, and in addition, provide some evidence that these claims concern matter intended to be claimed in the original application. *See Wayne-Gossard Corp. v. Sondra, Inc.*, 434 F.Supp. 1340, 1355 (E.D. Pa. 1977) *aff'd* 579 F.2d 41 (3d Cir. 1978).

There is additional support for the later-added claims in the specifications of the parent application, which were carried forward unchanged into the application for the patent in suit and ultimately into the patent in suit itself. As stated in the specifications:

> When the snubber 132 is assembled with the body spring 170 it extends between the side frame bottom member 121 and the bolster bottom surface 168 as seen in FIG. 12. Also as seen in FIG. 12 the top surface 122 of the side frame bottom member 121 will, when the bolster and side frame are assembled but not supporting a car, be at a level indicated by the line A-A relative to the bolster 118. When a car body is placed on the truck of which this side frame 120 and bolster 118 are a part, the relative position of the top surface 122 of the side frame bottom member 121 will be at a position, relative to bolster 118, represented by the horizontal line B-B.

> This would be the unloaded car position and it is well illustrated that in this position there would be little or no action by the snubber 132 even if the car should bounce somewhat or rock slightly as it was being propelled over the rails. The next horizontal line upward from line B-B namely C-C represents the normal position of the top surface 122, relative to bolster 118, with a loaded car and it is to be seen that at this time the hitherto fully downwardly extended piston rod 154 will be forced upwardly into the cylinder 150 by the slight amount represented by the height of the line C-C above the downward-most positioning of the bottom member 164 in FIG 12. The top-most of the horizontal lines namely D-D represents the position of the top surface 122 relative to the bolster 118 when the spring group has been completely collapsed into solid condition.

[PX-6, circle page 22, line 17-23, line 14.][10] The parent application's specifications also include the following:

> The snubber 132 is now ready for normal operation very similar to that described for the spring group snubber of the above copending application or for the embodiment of FIGS 1 through 4 of this application. As hereinbefore mentioned, the limit of extension of the piston rod 154 precludes any action of the snubber 132 with a light car so that true operation of this device begins with a loaded car being moved along a railway and responding to the variations in track height in a well known manner.

[PX-6, circle pages 24, line 24-25, line 4.] These specifications are clearly adequate to support the claims of the patent in suit, which are the use of a biasing spring to maintain the snubber out of operative engagement with

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10. "Figure 12" as referred to in the disclosure of the parent application corresponds to Figure 8 of the patent in suit. This drawing is Figure 1 of this opinion.

the bolster or side frame when a car is unloaded, and to allow initiation of snubbing, in the normal case, only when the car is operating in a loaded condition. Moreover, the inventor testified that at the time the application for the patent in suit was filed, he was aware of other claims that could be made for the disclosed invention, but allowed the application to proceed on the assumption that these claims could be added later. (N.T. 11.15-11.27) The patent in suit is not, therefore, invalid for late claiming, or for failure to file a supplemental oath in support of the later-added claims. We should add that this conclusion is in accordance with the determination necessarily made by the Patent Office in allowing the new claims, and in not requiring the swearing of a supplemental oath. Such actions of the Patent Office are presumptively proper. *Baldwin-Lima Hamilton Corp. v. Tatnall Measuring Systems*, 169 F. Supp. at 21; *Eli Lilly and Co. v. Premo Pharmaceutical Laboratories*, 630 F.2d at 133-34.

Plaintiff has contended throughout these proceedings that even if the patent is valid, as we have determined that it is, the plaintiff acquired intervening rights to continue the manufacture and sale of its infringing snubber because defendant amended its claims after viewing plaintiff's device, and the claims as originally filed were not broad enough to cover plaintiff's infringing device. Testimony was presented by the defendant that, while the inventor had viewed plaintiff's device in operation before the amended claims were filed, the amendments had been conceived earlier, and were later filed in order to assure foreign patent protection. (N.T. 6.130, 6.144, 11.16) Plaintiffs, on the other hand presented contrary testimony in an attempt to show that the amendment was motivated by the defendant's viewing of plaintiff's device. The jury in finding that the doctrine of intervening rights did not apply credited the testimony offered by the defendant. Furthermore, there is a

question as to whether the doctrine of intervening rights is applicable to the circumstances presented in this case.

The doctrine of intervening rights in its statutory embodiment appears limited to reissue patents:

> No reissued patent shall abridge or affect the right of any person or his successors in business who made, purchased or used prior to the grant of a reissue anything patented by the reissued patent, to continue the use of, or to sell to others to be used or sold, the specific thing so made, purchased or used, unless the making, using or selling of such thing infringes a valid claim of the reissued patent which was in the original patent. The court before which such matter is in question may provide for the continued manufacture, use or sale of the thing made, purchased or used as specified, or for the manufacture, use or sale of which substantial preparation was made before the grant of the reissue, and it may also provide for the continued practice of any process patented by the reissue, practiced, or for the practice of which substantial preparation was made, prior to the grant of the reissue, to the extent and under such terms as the court deems equitable for the protection of investments made or business commenced before the grant of the reissue.

35. U.S.C. §252. Plaintiff contends, however, that the doctrine should be applied to original issue patents in circumstances where, as here, new claims have been added subsequent to initial application in order to cover an infringing device. Support for such a contention may be found in the case of *Kahn v. Dynamics Corp.*, discussed previously. *See* P. Rosenberg, Patent Law Fundamentals, §7.14 at 7-41. However, as we have heretofore stated, we have joined with those courts which have rejected the *Kahn* rationale. Since it is unquestionably proper for an inventor to add claims to an invention to add claims to an invention which are

adequately supported by the initial disclosure, and since we have found that the disclosure in the original application was sufficient to support the claims which plaintiff contends were added improperly, we do not find a basis for granting plaintiff intervening rights to make and sell the infringing device.[11]

Finally, we note that the doctrine of intervening rights, as §252 itself indicates, is an equitable doctrine, designed to allow a person who has in good faith manufactured an infringing device, and who has made a substantial investment in such production, to recover these profits. *See Wayne-Gossard Corp. v. Sondra, Inc.*, 434 F. Supp. at 1362-63. It is perhaps for this reason that plaintiff has contended that defendant's actions in filing the later claims were "improper and greedy." Plaintiff 's Reply Memorandum in support of its motion for Judgment NOV. at 50. As our discussion of the "late claiming" doctrine has made clear, there was nothing improper about defendant's addition of the claims. Furthermore, there is no evidence of substantial preparatory expenditure by the plaintiff which would justify granting it intervening rights in this case. Plaintiff 's president testified that he designed and built the infringing device in three weeks, using many components from a snubber already manufactured by the plaintiff. (N.T. 2.38-39) Plaintiff 's investment in the development of the product thus appears to have been insubstantial. Further, there is evidence that plaintiff made substantial profits on its sale of the device. *See Railroad Dynamics, Inc. v. A. Stucki Company*, No. 76-800, slip op. at 12 (E.D. Pa. Au-

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11. Plaintiffs also rely on the Third Circuit case of *Galion Iron Works & Mfg. Co. v. Beckwith Machine Co.*, 105 F.2d 941, 941 n.1 (1939) which states the proposition that enlargements of applications by later-added claims must be strictly construed and cannot interfere with inventors who have entered the field meanwhile. There is no indication in the *Galion* case, however, that the later-added claims to which the court referred were unsupported by the original disclosure.

gust 25, 1981). Finally, as discussed later, the plaintiff has been ordered as a result of this action to pay only a reasonable royalty to the defendant for its infringement of the patented invention. slip op. at 19. The Court believes such a royalty allows plaintiff to recover its production and development costs incurred in the manufacture and sale of the infringing device, and in fact to retain a profit from such sale. *Id.* For all of the above reasons, this Court must, therefore, deny plaintiff 's motion to set aside the finding of the jury that the plaintiff failed to prove by a preponderance of the evidence that plaintiff acquired intervening rights under the '292 patent.

The jury answered the following interrogatory in the negative:

> 9. Do you find that plaintiff has proved by a preponderance of the evidence that it has acquired intervening rights under United States Patent No. 3,387,292?

Sufficient evident supports this finding. Further, this Court must also deny plaintiff's motion to set aside the jury findings that the plaintiff failed to prove with sufficient evidence that the '292 patent was invalid for late claiming and failure to file a supplementary oath.

The jury answered the following interrogatories in the negative:

> 4. Do you find that plaintiff has proved by clear and convincing evidence that United States Patent No. 3,837,292 is invalid on the ground that the amendment to the patent application filed on April 18, 1972 required a supplemental oath or declaration in that the amendment contained matter originally shown or described but not substantially embraced in the statement of invention or claim originally presented in the application?
>
> 5. Do you find that the plaintiff has proved by clear and convincing evidence that United States Patent No. 3,387,292 is invalid for late claiming?

The jury also answered the following interrogatory affirmatively:

> 2. Do you find that defendant has proved by a preponderance of the evidence that the effective filing date of the invention claimed in United States Patent No. 3,837,292 is August 22, 1969?

These answers are supported by sufficient evidence, and by the law. For all of the above reasons, the plaintiff's motion for judgment notwithstanding the verdict and, in the alternative, for a new trial will be denied.

Damages Issues

Rule 60(a) motion

Following entry of this Court's judgment on August 26, 1981, the defendant filed a motion pursuant to Fed.R.Civ.P. 60(a) to correct a clerical mistake in the judgment. A stipulation of the parties had been entered into prior to entry of judgment, which was intended to make clear the number of car sets sold by the plaintiff during the relevant period. This stipulation was filed with the Court, but for some unexplained reason, was not entered into the record until after the Court had calculated the damages and entered judgment. The defendant therefore seeks to correct the figures stated at page 25 of this Court's August 25, 1981 Memorandum on damages to reflect the stipulated figures. Plaintiff agrees that the judgment should be corrected. A revised table with the correct figures, computed on the same basis as was the original table, is as follows:

	RDI Carsets Shipped	Royalty ($35.00/ Carset)	Royalty with Compound Interest at 6%
12/1/74 - 4/30/75	2,406.75	84,236	124,400
5/1/75 - 4/30/76	5,043.00	176,505	245,977
5/1/76 - 4/30/77	6,805.00	238,175	312,105
5/1/77 - 4/30/78	7,145.00	250,075	309,493
5/1/78 - 4/30/79	9,488.00	332,080	386,807
5/1/79 - 4/30/80	13,296.00	465,360	513,013
5/1/80 - 2/9/81	7,999.75	279,991	291,191
TOTAL	52,183.50	1,826,422	2,182,986

The plaintiff, however, objects on substantive grounds to the inclusion of 204.75 carsets shipped in December, 1974, and to the inclusion of 1,671 carsets shipped in 1977 and 1978 which represent "foreign sales". The plaintiff also objects to the inclusion of interest. We reject these objections for the reasons stated below in our discussion of plaintiff's motion to alter or amend the judgment. Plaintiff also requests a clarification of the manner in which the interest figures were calculated. The interest was calculated at an annually compounded 6% rate from January 1st of each year (approximately the midpoint of each fiscal year for which data was supplied) to August 26, 1981, the date judgment was entered. Decimals were rounded to the nearest hundredth. Each royalty figure was thus multiplied by 1.04 to represent the interest accruing from January 1, 1981 to August 26, 1981. (237 days ÷ 365 days = .65, .65 x .06 = .04) Each royalty figure was also multiplied by a factor of $(1.06)^n$, where "n" was equal to the number of years between January 1 of the fiscal year in which those royalties would have been paid and January 1, 1981. As an example, in fiscal 1978, the royalty payment we have deemed should have been paid was $250,075. Since three years elapsed between 1978 and 1981, "n" is equal to three. 1.06 raised to the third power is 1.19, which multiplied by 1.04 and 250,075 yields the result of $309,493. In accordance with the above calculations the judgment will be amended to enter judgment in favor of defendant and against plaintiff in the amount of $2,182,986.

Rule 59 motions

Both parties moved pursuant to Fed.R.Civ.P. 59 for an alteration or amendment of the amount of the judgment, contending that this Court made errors in arriving at the amount of the damages. The contentions raised in

these motions are identical to the arguments presented by the parties before the Court prior to the Court's initial determination of damages. Furthermore, it appears that all of them were considered by the Court in its Memorandum of August 25, 1981. Upon reconsideration, the Court concludes that neither party has presented any reason to change the basis for this Court's determination of damages, except the mathematical error brought about by the absence of the stipulation at the time damages were initially calculated. Therefore, the motions of both parties to alter or amend the judgment will be denied. The motion to correct the clerical error in the calculation of damages will be granted.

The plaintiff challenges this Court's award of prejudgment interest. Such an award is discretionary with the trial court. *Georgia-Pacific Corp. v. U.S. Plywood Champion Papers, Inc.*, 446 F.2d 295, 301 & n.7 (2d Cir.), *cert. denied*, 404 U.S. 870 (1971). The Court in its previous Memorandum explicitly found that "exceptional circumstances" justified an award of prejudgment interest. Memorandum of August 25, 1981 at 24. The plaintiff takes issue with our finding, contending that its failure to enter into a license agreement with the defendant cannot support such a finding, and that it is contrary to public policy to penalize challenges to invalid patents. As the Third Circuit noted soon after this Court's Memorandum as to damages was filed, however, sound public policy dictates an award of prejudgment interest as of the date of infringement, since failure to award such interest "rewards infringers where those infringers have refused to accept or negotiate a royalty, and discourages the amicable licensing of patents." *Devex Corp. v. General Motors Corp.*, 667 F.2d 347, 364 (3d Cir. 1981), *cert. granted*, 102 S.Ct. 2267 (1982), *cert. denied*, 102

S.Ct. 2270 (1982).[12] *See Pitcairn v. United States*, 547 F.2d 1105, 1120-24 (Ct. Cl. 1976), *cert. denied*, 434 U.S. 1051 (1978). Moreover, the Court's finding was not simply that the plaintiff had refused the offer, but that it did not respond to it and proceeded to sell its infringing snubber in substantial quantities. Memorandum at 24. Finally, the Court found, in its discretion, that the award of prejudgment interest was necessary in this case to insure full compensation to the defendant for plaintiff's acts of infringement. *Id.* The Court finds that the 6% rate of interest is most reasonable and warranted by the facts of this case.

Plaintiff also contends that the royalty set by the Court was unreasonably high. The Court's Memorandum of August 25, 1981 considered each of the fifteen factors set out in the lower court opinion in *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 F. Supp. at 1120, and we adhere to our earlier determinations with respect to these factors. Although plaintiff points out that in our Memorandum of August 25, 1981 this Court referred to a royalty arrangement offered by defendant to plaintiff as an "exclusive" arrangement, there is no question that our determination that a thirty-five dollar per carset royalty rate was reasonable was not based on our inadvertent reference to the license as "exclusive". Rather, it was based on all of the factors considered by the Court, including the exact language of the offer itself. We note that our ultimate finding, which

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12. The Supreme Court's grant of certiorari in *Devex* was limited solely to the question of whether 35 U.S.C. §284 *requires* an award of prejudgment interest on unliquidated reasonable royalty patent infringement damages where there has been *no* finding of bad faith or other exceptional circumstances, but rather a finding that the infringer acted in good faith. 50 U.S.L.W. 3870 (April 27, 1982). Even should the Supreme Court answer this question in the negative, we do not believe its holding will affect the power of a Court, in its discretion, to award prejudgment interest on the basis of findings such as we have made here.

placed reliance on the royalty arrangement offered by Stucki to RDI, is supported by two federal appellate courts which have considered this issue and have explicitly approved royalty rates in the amount of industry-wide license offers made by the patentee. *Devex Corp. v. General Motors Corp.*, 667 F.2d at 361-62.[13] *Pitcairn v. United States*, 547 F.2d at 1116-17. We thus find no basis to change our original determination as to the royalty rate.

The plaintiff further contends, relying on *Deepsouth Packing Co. v. Laitran Corp.*, 404 U.S. 518, 92 S.Ct. 1700 (1972) that its foreign sales should be excluded from the damages calculations because these snubbers were not placed in truck assemblies in this country, and therefore there was no infringement within this country. As the *Deepsouth* opinion states, however, infringement occurs under 35 U.S.C. §271 when a person " 'makes', 'uses', *or* 'sells' the patented product within the bounds of this country." 406 U.S. at 527 (emphasis added). Plaintiff's contention is therefore untenable, since it is not only the use of a patented device which constitutes infringement under §271, but manufacture and sale as well. Therefore, although the snubbers at issue were shipped for use outside the United States, since they were manufactured and sold within the United States, they should not be excluded from the damages calculation.

Finally, plaintiff contends that damages should not be assessed for December, 1974, because defendant has not proved that defendant marked its patented device to give notice of the issuance of the patent, or that defendant otherwise gave plaintiff actual notice of the patent's issuance, prior to January 1, 1975. The Court found in its Memorandum of August 25, 1981, at 21, that notice

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13. The Supreme Court denied certiorari on this question in the *Devex* case. *See* note 12, *supra;* 50 U.S.L.W. 3870 (April 27, 1982).

had been given as of December 1, 1974. The evidence, including the testimony of the inventor that marked snubbers were sold soon after marked castings were received in November, 1974, supports this finding.

For the reasons heretofore discussed, plaintiff's motion to alter or amend the judgment will be denied.

The defendant has also challenged some of this Court's findings. Defendant claims that the Court erred in finding that defendant did not carry its burden of proving lost profits. Memorandum of August 25, 1981, at 9. Defendant, however, has failed to convince the Court that it should change the findings set forth in the Court's Memorandum of August 25, 1981, at 7-9, which provided ample support for the finding that defendant had not carried its burden of proving lost profits. There was no evidence in the record upon which this Court could base a finding as to the percentage of the plaintiff's infringing sales which would have been made by the defendant in the absence of infringement. The defendant also asserts that the Court's damage award to Stucki should give Stucki all of plaintiff's profits from the sale of plaintiff's infringing snubber, contending that plaintiff has been "unjustly enriched" in this amount. Such as award cannot be made, however, under 35 U.S.C. §284, as amended in 1946. The Supreme Court has stated:

> In patent nomenclature what the infringer makes is 'profits'; what the owner of the patent loses by such infringement is 'damages'. . . . By the 1946 amendment . . . the statute [the present 35 U.S.C. §284] was changed to approximately its present form, whereby only "damages" are recoverable. The purpose of the change was precisely to eliminate the recovery of profits as such and allow recovery of damages only. . . .
>
> But the present statutory rule is that only "damages" may be recovered. These have been defined

> by this Court as "compensation for the pecuniary loss he [the patentee] has suffered from the infringement, without regard to the question whether the defendant has gained or lost by his unlawful acts."

Aro Manufacturing Co. v. Convertible Top Co., 377 U.S. 476, 506, 507, 84 S.Ct. 1526, 1542 (1964) (citations and footnotes omitted). Defendant's claim for disgorgement of RDI's "unjust enrichment" must, on the authority of *Aro*, be rejected.

For all of the above reasons, defendant's motion to alter or amend the judgment will therefore be denied.

An appropriate Order follows.

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF PENNSYLVANIA

Civil Action
No. 76-800

RAILROAD DYNAMICS, INC.

v.

A. STUCKI COMPANY

ORDER

AND NOW, this 25th day of March, 1983, upon consideration of plaintiff's motion pursuant to Fed.R.Civ.P. 50(b) for judgment notwithstanding the verdict, in the alternative, for a new trial, defendant's motion pursuant to Fed.R. Civ.P. 60(a) to correct a clerical mistake in the judgment, defendant's motion pursuant to Fed.R.Civ.P. 59(e) to alter or amend the judgment, and plaintiff's motion pursuant to Fed.R.Civ.P. 59(e) to amend the judgment, and the responses thereto, for the reasons stated in this Court's Memorandum of March 25, 1983,

IT IS HEREBY ORDERED:

1. Plaintiff Railroad Dynamics, Inc.'s motion for judgment notwithstanding the verdict, or, in the alternative, for a new trial, is DENIED.

2. Plaintiff Railroad Dynamics, Inc.'s motion to amend the judgment of this Court entered August 26, 1981 is DENIED.

3. Defendant A. Stucki Co.'s motion to alter or amend the judgment of this Court entered on August 26, 1981 is DENIED.

4. Defendant A. Stucki Co.'s motion to correct a clerical mistake in the judgment of this Court entered on August 26, 1981 is GRANTED, and this Court's judg-

ment entered in the above entitled action on August 26, 1981 is hereby corrected, *nunc pro tunc*, to enter judgment in favor of defendant A. Stucki Co. and against plaintiff Railroad Dynamics, Inc. in the amount of $2,182,986.00.

IT IS FURTHER ORDERED that pursuant to the above correction, the judgment order entered by this Court on August 26, 1981 hereby is corrected *nunc pro tunc*, to read as follows:

> Judgment is ENTERED in favor of defendant A. Stucki Company and against plaintiff Railroad Dynamics, Inc. in the amount of $2,182,986.00.

RAYMOND J. BRODERICK, *J.*

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

No. 83-951/
83-961

RAILROAD DYNAMICS, INC.,
Appellant/Cross-Appellee,

v.

A. STUCKI COMPANY,
Appellee/Cross-Appellant.
Dist. Ct. No. 76-800

Judgment

ON APPEAL FROM THE US DISTRICT COURT
FOR THE EASTERN DISTRICT OF PENNSYLVANIA

This CAUSE having been heard and considered, it is ORDERED and ADJUDGED: AFFIRMED.

DATED: January 25, 1984
Petition for rehearing Denied, February 14, 1984, Suggestion for rehearing in banc, Declined, February 14, 1984.

ENTERED BY ORDER
OF THE COURT
George E. Hutchinson, Clerk

Clerk

ISSUED AS A MANDATE: February 14, 1984

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

No. 83-951/
83-961

RAILROAD DYNAMICS, INC.,
Appellant/Cross-Appellee,

v.

A. STUCKI COMPANY,
Appellee/Cross-Appellant.

ORDER

A petition for rehearing and a suggestion for rehearing in banc having been filed in this case,

UPON CONSIDERATION THEREOF, it is Ordered by the court that the petition for rehearing be, and the same is hereby Denied.

The suggestion for rehearing in banc is declined. The Mandate shall issue forthwith.

FOR THE COURT

George E. Hutchinson, *Clerk*

February 14, 1984

cc: Alan S. Nadel
Raymond G. Hasley

28 U.S.C. §1295. Jurisdiction of the United States Court of Appeals for the Federal Circuit

(a) The United States Court of Appeals for the Federal Circuit shall have exclusive jurisdiction—

(1) of an appeal from a final decision of a district court of the United States, the United States District Court for the District of the Canal Zone, the District Court of Guam, the District Court of the Virgin Islands, or the District Court for the Northern Mariana Islands, if the jurisdiction of that court was based, in whole or in part, on section 1338 of this title, except that a case involving a claim arising under any Act of Congress relating to copyrights or trademarks and no other claims under Section 1338(a) shall be governed by sections 1291, 1292, and 1294 of this title;

* * *

28 U.S.C. §1338. Patents, plant variety protection, copyrights, trade-marks, and unfair competition

(a) The district courts shall have original jurisdiction of any civil action arising under any Act of Congress relating to patents, plant variety protection, copyrights and trade-marks. Such jurisdiction shall be exclusive of the courts of the states in patent, plant variety protection and copyright cases.

* * *

35 U.S.C. §103. Conditions for patentability; non-obvious subject matter

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

35 U.S.C. §112. Specification

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

* * *

35 U.S.C. §282. Presumption of validity; defenses

A patent shall be presumed valid. Each claim of a patent (whether in independent, dependent, or multiple dependent form) shall be presumed valid independently of the validity of other claims; dependent or multiple dependent claims shall be presumed valid even though dependent upon an invalid claim. The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting such invalidity.

* * *

Rule 49. Special Verdicts and Interrogatories

(a) Special Verdicts. The court may require a jury to return only a special verdict in the form of a special written finding upon each issue of fact. In that event the court may submit to the jury written questions susceptible of categorical or other brief answer or may submit written forms of the several special findings which might properly be made under the pleadings and evidence; or it may use such other method of submitting the issues and requiring the written findings thereon as it deems most appropriate. The court shall give to the jury such explanation and instruction concerning the matter thus submitted as may be necessary to enable the jury to make its findings upon each issue. If in so doing the court omits any issue of fact raised by the pleadings or by the evidence, each party waives his right to a trial by jury of the issue so omitted unless before the jury re-

tires he demands its submission to the jury. As to an issue omitted without such demand the court may make a finding; or, if it fails to do so, it shall be deemed to have made a finding in accord with the judgment on the special verdict.

(b) General Verdict Accompanied by Answer to Interrogatories. The court may submit to the jury, together with appropriate forms for a general verdict, written interrogatories upon one or more issues of fact the decision of which is necessary to a verdict. The court shall give such explanation or instruction as may be necessary to enable the jury both to make answers to the interrogatories and to render a general verdict, and the court shall direct the jury both to make written answers and to render a general verdict. When the general verdict and the answers are harmonious, the appropriate judgment upon the verdict and answers shall be entered pursuant to Rule 58. When the answers are consistent with each other but one or more is inconsistent with the general verdict, judgment may be entered pursuant to Rule 58 in accordance with the answers, notwithstanding the general verdict, or the court may return the jury for further consideration of its answers and verdict or may order a new trial. When the answers are inconsistent with each other and one or more is likewise inconsistent with the general verdict, judgment shall not be entered, but the court shall return the jury for further consideration of its answers and verdict or shall order a new trial.

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF PENNSYLVANIA

Civil Action No. 76-800
Judge Broderick

RAILROAD DYNAMICS, INC.,

Plaintiff,

v.

A. STUCKI COMPANY,

Defendant.

PLAINTIFF'S REVISED PROPOSED SPECIAL VERDICT QUESTIONS

1. Is the art or technology pertaining to the subject matter claimed in Stucki's patent the art of suspension systems for truck assemblies for railway cars?

Yes_____
No_____

2. Is an engineer who has had several years experience in the railroad industry a person of ordinary skill in the art pertaining to the subject matter claimed in Stucki's patent?

Yes_____
No_____

3. Did the state of the art pertaining to the subject matter claimed in Stucki's patent prior to the alleged invention of the claimed subject matter include biasing a friction snubber in the spring group of a railway truck assembly away from the bolster by biasing means between the bolster and the snubber, such that when the truck assembly is normally operating in an unloaded condition, the snubber is out of operative engagement with the bolster, but when the truck assembly is normally operating in a loaded condition, the bias of the

biasing means is partially overcome and the snubber is in operative snubbing engagement with both the bolster and with the side frame?

Yes_____
No_____

4. Does the Holland volute spring group snubber arrangement illustrated in Plaintiff's Exhibit 78 include a snubber in the spring group of a railway truck assembly biased by a snubber biasing spring such that it is biased out of contact with the bolster in an unloaded car and does not normally snub an unloaded car, but is in contact with both the bolster and side frame if the car is loaded so it snubs a loaded car?

Yes_____
No_____

5. Do Kiesel, Jr. U.S. Patent 1,983,088 (Plaintiff's Exhibit 27, colored drawings Plaintiff's exhibit 79) and Symington U.S. Patent 1,989,433 (Plaintiff's Exhibit 60, colored drawings Plaintiff's Exhibit 80) disclose the use of a snubber in a spring group in substantially the same orientation claimed in Stucki's patent?

Yes_____
No_____

6. Do *Railway Age*, Volume 118, No. 9, March 3, 1945, page 421 (Plaintiff's Exhibits 68 and 82) and Sproul U.S. Patent 2,099,240 (Plaintiff's Exhibit 61, colored drawings Plaintiff's Exhibit 81) disclose a hydraulic snubber which replaces a spring in a spring group of a railway truck assembly?

Yes_____
No_____

7. Is the only difference between the subject matter claimed in Stucki's patent and the prior art that a hydraulic snubber, also known in the prior art, is used in the spring group of a railway truck assembly, rather than a friction snubber?

Yes_____
No_____

8. Is the prior art relied upon by RDI more pertinent to the subject matter claimed in Stucki's patent than the prior art relied upon by the Patent Examiner who examined the application for Stucki's patent?

Yes_____

No_____

* * *

(2) 83 - 1839

Office - Supreme Court, U.S.
FILED
MAY 11 1984
ALEXANDER L. STEVAS,
CLERK

No.

IN THE
SUPREME COURT OF THE UNITED STATES

October Term, 1983

RAILROAD DYNAMICS, INC.,
Petitioner

v.

A. STUCKI COMPANY,
Respondent

APPENDIX OF PATENTS AND ENGINEERING DRAWINGS TO THE PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

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EDITOR'S NOTE

THE FOLLOWING PAGES WERE POOR HARD COPY AT THE TIME OF FILMING. IF AND WHEN A BETTER COPY CAN BE OBTAINED, A NEW FICHE WILL BE ISSUED.

Appendix of Patents and Engineering Drawings

TABLE OF CONTENTS

Exhibit No.	Description	Page
PX-2	Wiebe U.S. Patent 3,837,292 (the patent in suit) (also identified as PD-51A during the damages trial).....	E-1
PX-77	Colored Figure 8 of patent in suit (PX-2) (also identified as PD-51B during damages trial).....	E-12
PX-409	Holland Company drawing Number B-333, February 8, 1966.....	E-13
PX-78	Colored Figure of Holland Company drawing Number B-333, February 8, 1966 (PX-409).....	E-14
PX-417	Louisville & Nashville R.R. Company drawing Number E-22228, March 18, 1968.....	E-15
PX-27	Kiesel U.S. Patent 1,983,088.....	E-16
PX-79	Colored Figure II of Kiesel Patent 1,983,088 (PX-27).....	E-20
PX-60	Symington U.S. Patent 1,989,433.....	E-21
PX-80	Colored Figure 2 of Symington U.S. Patent 1,989,433 (PX-60).....	E-26
PX-68	"Shock Absorber for Freigt Cars," Railway Age, Vol. 118, No. 9, p. 421, March 3, 1945.....	E-27
PX-61	Sproul U.S. Patent 2,099,240.....	E-28
PX-69	Settles U.S. Patent 2,573,165.....	E-32

Exhibit No.	Description	Page
PX-70	Williams U.S. Patent 3,005,629.....	E-41
PX-71	Funkhouser U.S. Patent 3,041,061.....	E-47
PX-72	Carter U.S. Patent 3,145,055.....	E-52
PX-73	Blake U.S. Patent 3,351,336.....	E-56
PX-25	Seay U.S. Patent 3,464,366.....	E-64

United States Patent [19]

Wiebe

[11] **3,837,292**

[45] **Sept. 24, 1974**

[54] **HYDRAULIC TRUCK SNUBBER**

[76] Inventor: **Donald Wiebe**, R.D. No. 3, Sewickley, Pa. 15143

[22] Filed: **Apr. 15, 1971**

[21] Appl. No.: **134,126**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 857,274, Aug. 22, 1969, Pat. No. 3,595,350, which is a continuation-in-part of Ser. No. 709,142, Feb. 28, 1968, abandoned.

[52] **U.S. Cl.** ..... **105/197 DH**, 188/321, 267/4, 267/8 R, 267/127

[51] **Int. Cl.** **B61f 5/12**, F16f 9/06, F16f 9/32

[58] **Field of Search** ..... 105/197 R, 197 D, 197 DB, 105/199 CB, 199 R, 197 DH; 188/321; 267/4, 8 R, 127

[56] **References Cited**

UNITED STATES PATENTS

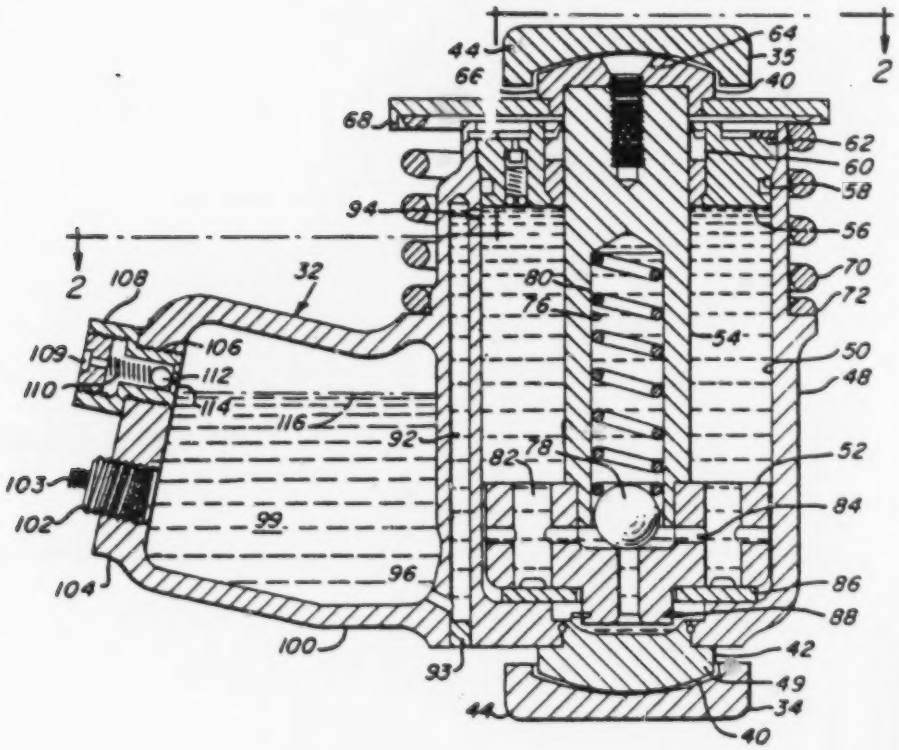
2,099,240	11/1937	Sproul	267/4
2,573,165	10/1951	Settles	105/197 DH
3,005,629	10/1961	Williams	105/197 D X
3,041,061	6/1962	Funkhouser	267/8 R
3,145,055	8/1964	Carter	267/127 X
3,351,336	11/1967	Blake	105/199 CB X
3,464,366	9/1969	Seay	105/197 D
3,595,350	7/1971	Wiebe	105/197 D X
3,626,864	12/1971	Wiebe	105/197 D X

Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—Howard Beltran
Attorney, Agent, or Firm—Howard E. Sandler

[57] **ABSTRACT**

A hydraulic snubber device for railroad car trucks to be interposed between a bolster end and side frame member. This device being of minimum height for a given useful stroke because ullage volume is provided in a reservoir outside the snubber cylinder.

10 Claims, 9 Drawing Figures



PLAINTIFF'S EXHIBIT 2

PATENTED SEP 24 1974

3,837,282

SHEET 1 OF 3

FIG. 1

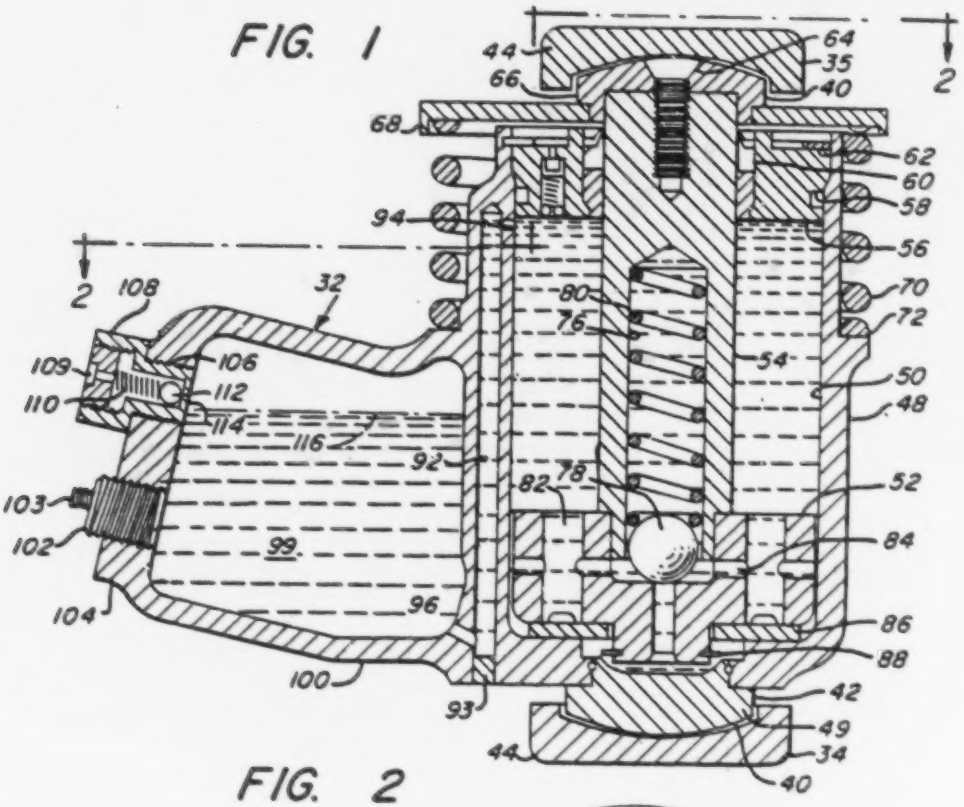
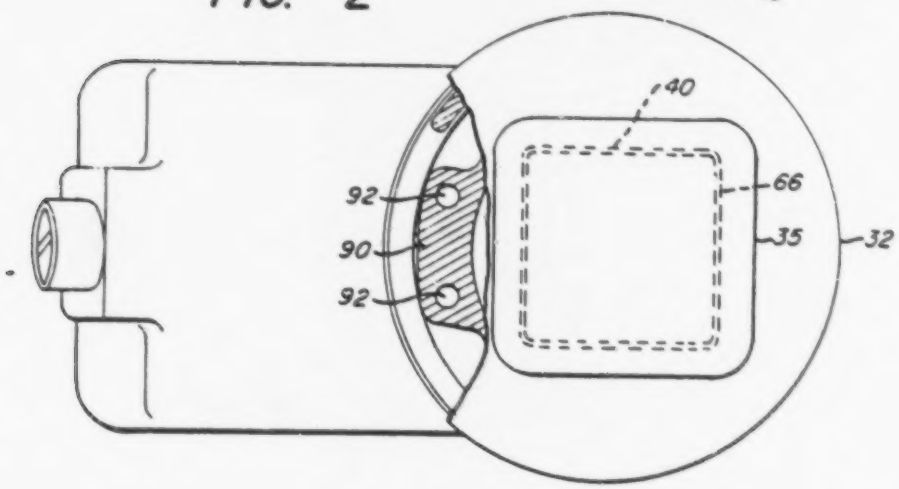


FIG. 2



INVENTOR
DONALD WIEBE

PATENTED SEP 24 1974

3,837,292

SHEET 2 OF 3

FIG. 9

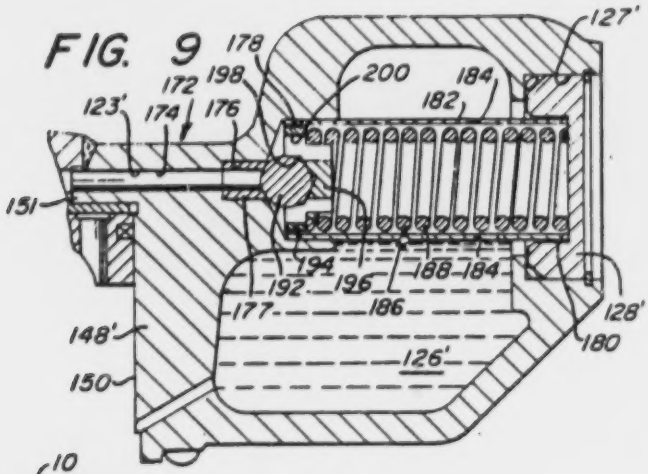


FIG. 3

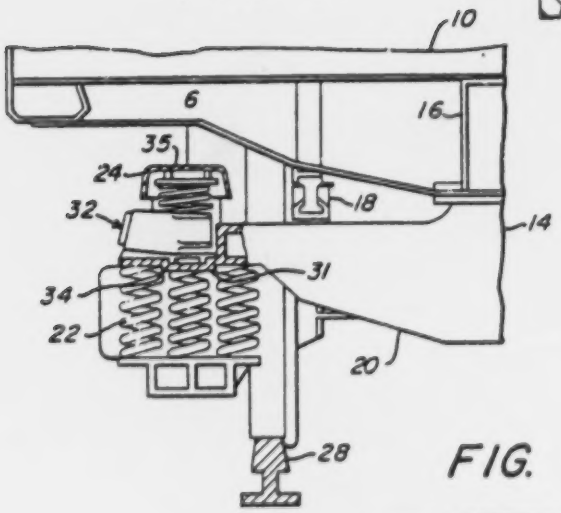
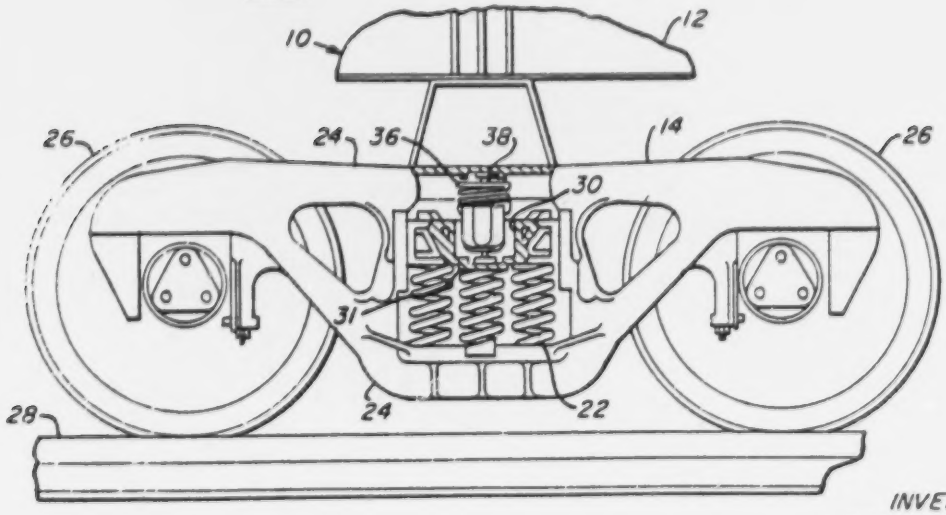


FIG. 4



INVENTOR
DONALD WIEBE

PATENTED SEP 24 1974

3,837,292

SHEET 3 OF 3

FIG. 5

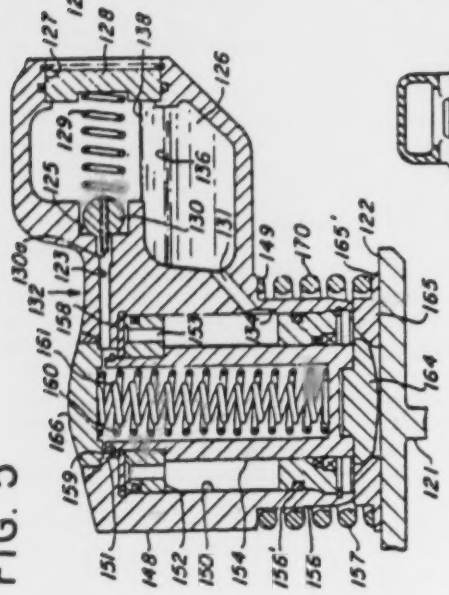


FIG. 6

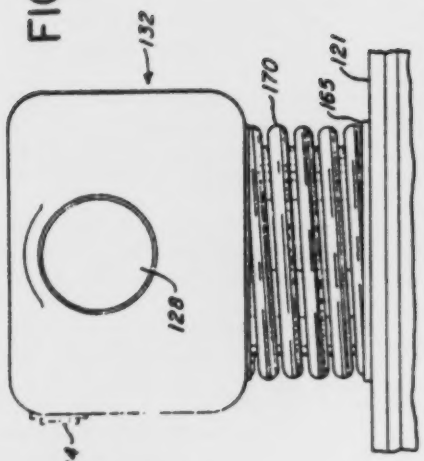


FIG. 7

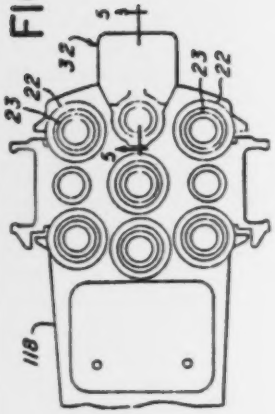
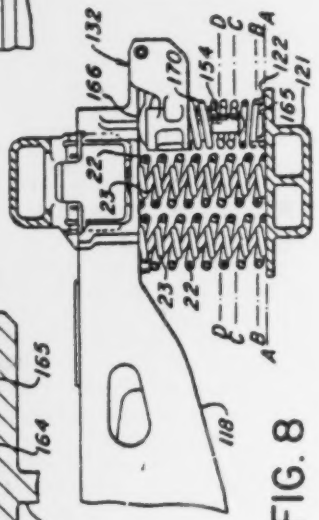


FIG. 8



HYDRAULIC TRUCK SNUBBER

This application is a continuation-in-part of U.S. Pat. application Ser. No. 857,274, filed Aug. 22, 1969, now U.S. Pat. No. 3,595,350 which in turn is a continuation-in-part of U.S. Pat. application Ser. No. 709,142 filed Feb. 28, 1968, now abandoned.

The structure of this invention provides an external reservoir for hydraulic fluid which cooperates with the snubber cylinder space to virtually eliminate the dead space or ullage volume normally necessary, at the top, within a closed hydraulic cylinder to provide for the volume of hydraulic liquid displaced by the piston rod when the piston is forced to the bottom of the cylinder. In the structure of this invention the external reservoir provides the ullage volume necessary for the operation of the piston within the cylinder so that the cylinder can be designed to operate effectively over its full stroke, with practically zero ullage volume within the cylinder.

It is therefore an object of this invention to provide a new and improved side frame snubber designed to operate at full efficiency as an energy absorbing structure throughout the full stroke of the piston within the cylinder.

These and other objects and advantages of the snubber of this invention will become more readily apparent upon consideration of the following description and drawings in which:

FIG. 1 is a median sectional view of a snubber constructed according to the principles of this invention;

FIG. 2 is a partially sectional view of the snubber of FIG. 1 taken substantially on line 2—2 of FIG. 1;

FIG. 3 is a fragmentary partially sectional and elevational view of a freight car body and truck incorporating the snubber of this invention;

FIG. 4 is a side elevational, partially sectional view of the structures shown in FIG. 3;

FIG. 5 is a sectional view of another snubber constructed according to the principles of this invention; taken substantially on line 5—5 of FIG. 6;

FIG. 6 is an end elevational view of the snubber of FIG. 5;

FIG. 7 is a top plan schematic view of a spring group incorporating the snubber of FIG. 5;

FIG. 8 is a fragmentary partially sectional schematic view of the spring group of FIG. 7;

FIG. 9 is a partial sectional view of still another snubber constructed according to the principles of this invention and similar to the embodiment shown in FIG. 5.

Referring now to the drawings, FIG. 4 shows a fragmentary portion of a railway car 10 comprising a freight car body 12 supported by a four-wheel truck (only one half being shown) by way of a center plate 16 and side bearings 18 (see FIG. 3) cooperating with a bolster 20, mounted upon two sets of compression type springs 22, mounted in a pair of side frames 24 each supported by a pair of suitably journaled wheels 26 resting upon a pair of tracks 28 all as well known to those familiar with the field of railway car design.

The bolster 20 is of conventional design except that an opening 30 has been formed in each end portion of the bolster 20 to provide space for mounting a snubber 32 constructed according to the principles of this invention. The bottom surface of the open space 30 has a downwardly recessed portion 31 positioned centrally

of the opening 30 to accept and maintain the positioning of a substantially square cup shaped lower mounting element 34 hereinafter more fully described (see FIG. 1).

Side frame 24 is likewise of conventional construction except that at a central portion of the underside of its top member there is formed a downwardly depending ring element 36 having a blind central opening of substantially square outline therein to accept, and maintain the positioning of a generally inverted cup shaped upper mounting element 35 (hereinafter more fully described, see FIG. 1) with the snubber 32 extending between the lower mounting element 34 and the upper mounting element 35 cooperating to form a pair of bearing surfaces for the reaction imposed upon the snubber 32 by the bolster 20 and the side frame 24 as hereinafter more fully set forth.

As shown in FIGS. 3 and 4 the mounting elements 34 and 35, respectively, are of generally rectangular or square outline with a concave internal depression 40 of partial cylindrical form in each mounting element 34, 35. The cylinder axis of each depression 40 is contained in a plane normal to the outer surface of the respective mounting element 34, 35 and also normal to opposite sides of the square outline of the respective mounting element.

Seated in and cooperating with the depression 40 of the bottom mounting element 34 is a snubber bottom member 42 of generally rectangular or square outline having a convex partially cylindrical bottom surface 44 and having its cylinder axis in the same plane as that described for the concave surface of the depression 40.

The snubber 32 comprises a generally hollow cylindrical body member 48 having a central opening 49 in the bottom thereof, closely receiving and retaining in fluid tight relationship an upwardly extending cylindrical portion of the snubber bottom member 42 to form a closed bottom for the internal cylindrical surface 50 of the body member 48 wherein a suitable piston 52 is axially reciprocable. The piston 52 is rigidly secured to and movable by an upwardly extending cylindrical piston rod member 54 which extends upwardly throughout the axial length of the body member 48, through and beyond an annular cylinder closure member 56 mated to and closely received by the cylindrical surface 50 and maintained in fluid tight relationship with the cylinder 50 and the exterior of the piston rod 54 by suitable sealing members such as O rings 58 and U-type seals 60, respectively, or other suitable sealing elements. A lock ring 62, or other suitable retaining means, secures the cylinder closure member 56 within the cylindrical surface 50 while the piston rod 54 is maintained in slidable relationship with the central bore in the cylinder closure member 56 as is well known in the hydraulic cylinder art. Mounted on the upper end of the piston rod 54 and rigidly secured thereto as by one or more threaded retaining elements such as a cap screw 64 is an inverted cup-shaped snubber top member 66 having a convex partial cylindrical reaction surface 44 thereon of the same character and radius as the reaction surface 44 of the snubber bottom member 42 herein before described.

Abuttingly engaged with a lower surface of the exterior of the snubber top member 66 is a spring retaining cap member 68 rigidly secured by the snubber top member 66 to travel with the piston rod 54 in axial reciprocation. A cylindrical compression type spring 70

is engaged between the underside of the cap member 68 and an external shoulder 72 formed on the outer surface of the cylindrical body member 48 and is sufficiently compressed so that in the absence of other forces the spring 70 will extend the piston rod 54 from the body member 48 until the piston 52 contacts the bottom of the cylinder closure member 56 in a manner common to single acting hydraulic cylinders.

The piston 52 and the piston rod 54 are similar to that described and shown in the above-cited copending application in that the piston 52 is provided with a central bore 74 which communicates with a blind central bore 76 in the piston rod 54 when the pressure on the bottom of the piston 52 is great enough to raise a ball valve 78 biased against the upper end of the central bore 74 by a spring 80 captively mounted in a compressed condition within the blind bore 76. The piston 52 is also provided with a plurality of bores 82 extending therethrough from its bottom to its top surface and communicating with the central bore 74 by respective horizontal passages 84. In the position shown in FIG. 1 the bores 82 are closed by a flat ring valve 86 covering the bottom ends of the bores 82 whenever pressure below the piston is substantially greater than pressure above the piston due to downward motion of the piston 52 within the cylinder 50. The valve 86 is free to move downwardly with respect to the bottom of the piston 52 a limited distance and prevented from moving farther in the axial direction with respect to the piston 52 by a suitable snap ring 88 mounted on a downwardly extending cylindrical portion of the piston 52 as described in the above cited copending application.

The body member 48 has a thick wall portion 90 (see FIG. 2) extending from the bottom of the body member 48 up to an area slightly above the bottom surface of the cylinder closure member 56 (as best seen in FIG. 1). Within the wall portion 90 is formed a pair of passageways such as elongated bores 92 having axes parallel to the axis of the cylinder 50 and extending within the wall portion 90 from the bottom of the body member 48 nearly to the top of the thick portion 90 at least as far up as the bottom surface of the cylinder closure member 56. At a point just below the bottom surface of the cylinder closure member 56 horizontal passageways 94 communicate between the interior of the cylinder 50 and the passageways 92, respectively. Similar substantially horizontal passageways 96 communicate between lower end portions of the bores 92 and the interior space 99 of a generally rectangular, substantially horizontally extending reservoir or hollow tank element 100 formed as a lateral extension of the body member 48 secured to or formed integral with the lower half of the body member 48. The bottom ends of the bores 92 are sealed by plugs 93 so that the interior space 99 communicates with the cylinder 50 through the passageways 96, 92 and 94 with the result that hydraulic liquid within the cylinder 50 can be displaced outwardly into the interior space 99 of the tank element 100 or caused to flow in the opposite direction as hereinafter more fully described.

The tank element 100 is provided with a threaded hollow plug 102 suitably threadedly engaged in a filler opening in the lower portion of an outer end member 104 of the tank element 100 and having a suitable check valved connection 103 thereon to provide for filling the interior of the tank element 100 with liquid by the application of a suitable pressurized fluid conducting element (not shown) to the valve fitting 103 in a well known manner. A second threaded bore 106 communicates with an upper portion of the interior of the tank element 100 and has threadedly engaged therein an adjustable valve 108 provided with an internally threaded stepped bore 114 in which is engaged an adjusting element 109 captively securing a spring 110 biasing a ball valve 112 into engagement with a smaller portion of the bore 114 which communicates between the upper portion of the inner chamber of the tank element 100 and the ambient atmosphere. The adjusting element 109 is suitably adjusted so that the ball valve 112 will remain seated and prevent communication between the interior of the tank element 100 and the ambient atmosphere until the pressure within the interior space 99 of tank element 100 exceeds that of the ambient atmosphere by at least a pre-selected amount, preferably approximately 2–5 atmospheres in the present embodiment.

OPERATION

With the above described snubber 32 fully assembled and in the upright position as shown in FIG. 1 but with the piston rod 54 fully extended and the piston 52 abutting the bottom surface of the cylinder head 56 a suitable liquid having the requisite physical and chemical characteristics for use as a pressure transfer medium within an hydraulic cylinder is pumped into the space 99 through the connection 103 until compression of the air within the space 99, the bores 92 and the cylinder 50 produces a pressure of approximately 5 atmospheres. Under such pressure the air within the communicating spaces 99, 92 and 50 will be compressed to approximately one fifth its original volume with approximately four fifths of the tank space 99 and the cylinder 50 being filled with liquid so that the liquid in the tank reaches a level approximately that indicated by a horizontal line 116 across the space 99 (see FIG. 1). The stepped bore 114 is suitably located so that its inner end portion communicating with the space 99 determines the level 116 so that liquid flows out of the bore 114 when the tank is being filled and whenever the pressure within the space 99 overcomes the spring 110 at the pressure for which the valve 108 has been set. The level 116 must be far enough above the level of bores 96 so that the bores 96 are always submerged under operating conditions.

When the piston rod 54 is pushed downwardly into the cylinder 50 the piston 52 travels downwardly with the valve 86 open as long as the downward motion of the piston 52 is slow enough to avoid substantial pressure differential between the upper and lower sides of the piston 52 so that the liquid below the piston can flow upwardly through the bores 82 into the space within the cylinder 50 above the piston 52. During the inward motion of the piston rod 54 liquid and air must be displaced from the cylinder 50 because of the volume occupied by the increased portion of the piston rod 54 within the cylinder 50 (displacement volume). With a newly filled snubber 32 approximately one fifth of the space within the cylinder 50 will be occupied by air which, because of gravitational effect, will be accumulated at the top of the cylinder 50 so that displacement of the piston rod volume will increase the air pressure within the cylinder and force air in the top of the cylinder 50 to travel outwardly through the passageways 94, downwardly through the bores 92, horizon-

tally outwardly through the passages 96 into the space 99 where the air will rise in the form of bubbles through the liquid in the space 99 to become part of the trapped air volume above the level 116 within the space 99.

When the piston rod 54 again moves upwardly within the cylinder 50, removal of a portion of the volume of the rod 54 from the interior of cylinder 50 provides space for more oil within the cylinder 50 and this amount of liquid will be supplied by liquid from the space 99 flowing through the passages 96, upwardly through the bores 92, and horizontally inwardly through the passages 94, into the cylinder 50. Successive up and down motions of the piston rod 54 will thus cause an exchange of air in the cylinder 50 and oil in the space 99 until the cylinder 50 is completely filled with oil.

It is to be noted that the combined cross sectional area of the bores 92 or equivalent passageway means must be large enough to allow free flow of liquid therethrough (no orifice effect). Furthermore the total volume of such passageway or bores 92 must be small enough so that normal rod movement into cylinder 50 to within an inch of fully closed will displace more than enough liquid to completely fill the bores 92. Or vice versa this amount of liquid must flow into the cylinder during rod extension to originally displace the air and thereafter to keep the cylinder full of liquid at all times.

It is to be appreciated that without the tank element 100 and the communicating passageways as hereinabove described it has always been necessary in prior art snubbers to provide at least some liquid free space or ullage volume at the top of the cylinder so that displacement of liquid by the piston rod entering the cylinder would not cause unwanted overpressuring of the cylinder 50 with resultant damage to the sealing elements and unacceptable loss of the hydraulic fluid.

Because of the transfer of ullage volume in the present invention from the top of the cylinder 50 to the top of the space 99 the snubber 32 of this invention is usable throughout the total length of piston stroke since the piston is always completely covered by and filled with the hydraulic liquid and no space need be left empty at the top of the cylinder as was necessary in prior art snubbers.

The minimum volume unfilled by liquid within the space 99 above the level 116 (hereinafter the ullage volume) should not be less than approximately 150 percent of the volume of that portion of the piston rod which moves into and out of the cylinder 50 below the cylinder head 56 (hereinafter the displacement volume), to avoid overpressuring the snubber at full stroke, and to avoid preventing the flow of the air which has been pressurized in the top of the cylinder 50 through the passageways 94 and 96 and the bores 92. This ullage volume in the reservoir is preferably three to four times the volume of the bores 92 and the communicating passageways 94 and 96 with the passageways of a diameter to allow free flow of liquid with very little pressure drop. This ratio of volumes has been found to be great enough to give free volume above the level 116 sufficient to permit displacement of the column of liquid in the bores 92 to provide for purging of air from the bores 92 into the space 99. Thus the volume of the bores 92 must always be less than one half the total piston rod displacement volume so that flow of air from the bores 92 into the space 99 will not be prevented by compressibility of the air.

Operation of the snubber 32 of this invention is similar to that described for the snubber of my copending U.S. Pat. application Ser. No. 801,884, now U.S. Pat. No. 3,626,864 except for the flow of liquid into and out of the cylinder 50 and the space 99 as hereinabove described. Such operation of course includes the "dead band operation" and the free flow of oil through the piston 52 during slow downward movement of the piston 52 within the cylinder 50 as well as the high pressure energy absorbing flow of oil through the passageway 74 in the piston 52 past the ball valve 78 after compression of spring 80, during rapid downward movement of the piston 52 which closes the valve 86, all as described with relation to the side frame snubber of the above cited application.

Referring again to the drawings, FIGS. 5 through 8 show another embodiment of a reservoir type snubber 132 constructed according to the principles of this invention and quite similar to the reservoir type snubber 32 of FIGS. 1 and 2 excepting the snubber 132 of this embodiment is a spring group snubber, i.e., the snubber 132 is designed to replace one of the springs 22 of the standard spring group interposed between a standard bolster 118 and a standard side frame 120 in the truck of a railway freight car such as that indicated at 10 in FIG. 3.

The application of the snubber 132 is very similar to that described and illustrated in my copending U.S. Pat. application Ser. No. 801,884 filed Oct. 23, 1968 which also illustrates a spring group snubber. It is of course obvious that the spring group snubber type has the advantage of being applicable to a standard side frame and standard bolster with a minimum of reconstruction thus saving the expenses of designing and building special bolsters and side frames with the attendant expenses of special parts to be stocked and accounted for.

As best seen in FIG. 5 the snubber 132 comprises a body member 148 which provides a hollow cylindrical surface 150 in which a piston 152 is reciprocated by action of a piston rod member 154 which extends downwardly from the piston 152 through a closure member 156 rigidly secured in the lower open end of the cylinder 150 as by snap ring 157 and maintained in fluid tight relationship with the cylinder 150 by resilient members such as O-rings 156' or the like.

The top end of the cylinder 150 is permanently closed by a top member 166 secured in a stepped portion of the cylinder 150 as by welding. The top member 166 is shown as having an upwardly convex surface contacting the underside of the bolster end in place of the conventional spring as best seen in FIG. 8. It is to be seen that the snubber 132 replaces any one of the three outside springs 22 of the truck spring group along with one of the inner spring 23 shown in FIG. 8 to be coaxial with and cooperating with the outer springs 22 in a manner well known in railroad circles.

The bottom end of the piston rod 154 is provided with a solid bottom member 164 having a downwardly convex surface and a bottom edge chamfer adapted to be received in a mounting ring 165 secured or trapped in place between a spring 170 and the uppersurface 122 of the side frame bottom member 121. The body support spring 170 surrounds a reduced diameter outside surface portion of the body member 148 and is in-

terposed between an annular shoulder 149 of the body member 148 and the shouldered top surface 165' of the mounting ring 165. As best seen in FIG. 8 the body spring 170 in this position supports the body member 148 in all relative positions of the bolster and side frame and holds the mounting ring 165 in place.

The internal workings of the snubber 132 are quite similar to those of the snubber 32 of the first embodiment with the difference that the snubber 132 is in many respects a top to bottom reversal of the snubber 32. The piston 152 is provided with a ring of vertical through bores 153 having axes parallel to the axis of the piston rod 154 and circumferentially spaced about the axis of the piston 152 and radially equidistant therefrom. Covering the top ends of the bores 153 is an annular disc valve 158 loosely slidable upon a through piston extension portion of the piston rod 154 and prevented from displacement off this extended portion by means such as the snap ring 159 which nevertheless allows the valve 158 to move far enough away from the bores 153 to allow a free flow of hydraulic fluid therethrough. The piston rod 154 is of course sealingly slidable through the closure member 156 and the piston and piston rod 154 are biased downwardly by coaxial double compression springs 160 and 161 outer and inner, respectively. The piston 152 is movable upwardly in the cylinder 150 until it comes in contact with the shoulder formed by the transition from the full diameter portion of the cylinder 150 to a smaller diameter portion 151 and this smaller diameter portion 151 extends upwardly to the bottom side of the top member 166 forming a small diameter top cylinder portion at the extreme upper end of the cylinder 150. This small diameter portion 151 communicates with a passageway 123 extending substantially horizontally to the right as seen in FIG. 5 to an enlarged passageway portion 125 which in turn communicates with the cavity of a reservoir 126 formed in a horizontally extending portion of the body member 148. The bore 123 must be large enough to provide for free flow of hydraulic liquid (no orifice effect) probably not less than ⅛ inch in diameter. The reservoir 126 is provided with a large horizontal bore 127 coaxial with the passageways 123 and 125 through the outer wall of the reservoir 126. Rigidly secured within the bore 127 is a closure member 128 provided with a snap ring and O-ring to maintain the fluid tight relationship of the closure member 128 with the bore 127. The closure member 128 forms a seat for a valve spring 129 interposed between the inner surface of the closure member 128 and a spherical valve 130 which is positioned in the portion 125 to close off the reservoir end of the passageway 123 in a well known manner. An orifice 130*a* is shown as a bore through valve 130 coaxial with the bore 123 and of a size to provide for viscous flow of hydraulic liquid under pressures ranging from a few atmospheres to whatever pressure will unseat the valve 130 probably around 140 atmospheres.

At this point it is well to note that the total volume of bore 123 plus the clearance volume within cylinder portion 151 with the piston at maximum height must be less than 1 percent of the piston displacement volume to provide for progressive clearing of air from the cylinder 150 to be replaced with liquid.

The reservoir 126 also communicates with the cylinder 150 through a passageway 131 extending from a lower portion of the reservoir 126 to a lower portion of the cylinder 150 wherein the passageway 131 is provided with a downwardly extending cylinder relief portion 134 extending downwardly from the passageway 131 in the wall of the cylinder 150 to a point upwardly adjacent the upper side of the closure member 156 for a purpose to be made clear.

When the snubber 132 is assembled with the body spring 170 it extends between the side frame bottom member 121 and the bolster bottom surface 168 as seen in FIG. 8. Also as seen in FIG. 8 the top surface 122 of the side frame bottom member 121 will, when the bolster and side frame are assembled but not supporting a car, be at a level indicated by the line A—A relative to the bolster 118. When a car body is placed on the truck of which this side frame 120 and bolster 118 are a part, the relative position of the top surface 122 of the side frame bottom member 121 will be at a position, relative to bolster 118, represented by the horizontal line B—B. This would be the unloaded car position and it is well illustrated that in this position there would be little or no action by the snubber 132 even if the car should bounce somewhat or rock slightly as it was being propelled over the rails. The next horizontal line upward from line B—B namely line C—C represents the normal position of the top surface 122, relative to bolster 118, with a loaded car and it is to be seen that at this time the hitherto fully downwardly extended piston rod 154 will be forced upwardly into the cylinder 150 by the slight amount represented by the height of the line C—C above the downwardmost positioning of the bottom member 164 in FIG. 5. The topmost of the horizontal lines namely D—D represents the position of the top surface 122 relative to the bolster 118 when the spring group has been completely collapsed into solid condition. At this positioning the piston 152 will be very nearly in contact with the shoulder at the top of the cylinder 150 while the mounting ring 165 is almost in contact with the bottom edge of the body member 148 with the parts almost in the position shown in FIG. 6.

By using a plug 124 in the forward wall of reservoir 126 (see FIG. 6) the inside of the body member 148 of the snubber 132 is properly filled with hydraulic liquid such as oil or other suitable liquid so that when in operation the level of liquid in the reservoir 126 will vary between a low level 136 shown as a broken line in FIG. 5 when the piston is at the bottom of the cylinder 150 and the rod 154 completely extended to the position shown in FIG. 8, and rising to the level shown as line 138 in FIG. 5 when the piston 152 has been pushed to the top of the stroke approximately as seen in FIG. 5.

OPERATION

In beginning the operation of a new snubber 132 there will likely be air trapped in the cylinder 150 and if the piston rod 154 is completely extended as seen in FIG. 8 all of the air in the cylinder 150 will be above the piston 152 by simple gravitational accumulation. At this time the level of liquid in the reservoir 126 will be at some unknown point higher than the level 136 because of the presence of air in the cylinder 150. As the piston 152 rises cyclically in the cylinder 150 because of the motion of the car, air above the piston 152 will be pushed through the small cylinder portion 151, ahead of oil present above the piston, into the passageway 123 and through orifice 130*a* or around the valve

130 into the upper regions of the reservoir 126. Thus, with the rod 154 being cyclically pushed into the cylinder 150 the level of the liquid in the reservoir 126 will gradually fall during the first few strokes as more and more air is gravitationally accumulated at the top of the cylinder 150 in the portion 151 and forced outward through the passageway 123. After a reasonable number of piston excursions upwardly and downwardly in the cylinder 150 the cylinder 150 and the bores 153 will be essentially completely filled with liquid with very little if any air remaining at the top of the small bore portion 151 or in the passageway 123.

The snubber 132 is now ready for normal operation very similar to that described for the spring group snubber of the above copending application or for the embodiment of FIGS. 1 through 4 of this application. As hereinbefore mentioned, the limit of extension of the piston rod 154 precludes any action of the snubber 132 with a light car so that true operation of this device begins with a loaded car being moved along a railway and responding to the variations in track height in a well known manner. With the car standing level or traveling on a level track the normal position of the piston 152 will be slightly raised from the upper surface of the closure 156 with the liquid in reservoir 126 at a level slightly above the line 136 since a small amount of the piston rod 154 has been forced into the cylinder 150 displacing a small amount of liquid. As the car begins to rock a first motion could be the downward motion of the bolster 118 toward the side frame bottom member 121 forcing the piston 152 higher into the cylinder 150. This action would force liquid from the upper side of the piston through the small cylinder portion 151 and the passageway 123 through the orifice 130a or out under the spherical valve 130 against the force of the spring 129 concentrated on a very small area at the end of the bore 123. When flow of liquid from cylinder 150 is taking place only through the orifice 130a energy absorption will be of the viscous flow type. This type of flow will be significant only during relatively slow bolster movement with respect to the side frame. However, during more rapid and forceful bolster movement forced displacement of the liquid above the piston 152 through the narrow opening formed by the slightly displaced valve 130 provides constant pressure energy absorption in a manner well known to be valuable in preventing excessive spring action whether in railroad cars or other vehicles. As the piston 152 is forced into the cylinder 150 the piston rod 154 of course displaces more and more liquid from the cylinder 150 into the reservoir 126 raising the level of the liquid to the line 138. The volume represented by the difference in the height 136 and 138 is the ullage volume that would be the minimum necessary to leave free in the cylinder for displacement purposes if the cylinder were not connected to an outside reservoir such as the reservoir 126.

When the bolster 118 begins to rise with relation to the side frame 120 the piston travels downwardly in the cylinder 150 and is able to do so readily and rapidly because the annular valve 158 will lift off the surface of the piston 152 as soon as the pressure below the piston is even slightly greater than the pressure above the piston as it travels downwardly. Since the valve 130 acts as a check valve liquid will not come into the top of the cylinder 150 from the passageway 123, nor will air except a small amount by leakage or through the orifice 130a. But the liquid below the piston 152 will travel upwardly through the bores 153 to keep the top of the cylinder full of oil even though the piston is traveling downwardly and the piston rod 154 is being removed from the cylinder and displacing less and less liquid therefrom so that liquid must now travel downwardly through the passageway 131 into the cylinder 150 to maintain a full cylinder at all times. If a small amount of air should travel inwardly through the passageway 123 into the cylinder 151 it will remain at the top of the cylinder by gravitational accumulation and will be the first fluid expelled when the piston 152 is again forced inwardly of the cylinder 150.

With the snubber 132 there will be a small amount of non-absorbing or "dead band effect" for small rapid vibrations when the piston 152 moves rapidly downward forcing valve 158 off the top surface of piston 152 which then quickly moves upwardly a short distance before valve 158 has regained its seated position so that no piston displacement of liquid has occurred. For greater "dead band effect" a spring (not shown) can be interposed between valve 158 and piston 152 to prolong the above described action during less rapid or larger piston excursions.

It is further to be noted that the minimum volume of air space above the level 136 must be greater than one-fifth of the rod displacement volume to avoid overpressuring reservoir 126 and the minimum normal operating level would have a volume of oil between the top end of passageway 131 and level 138 at least equal to the total possible piston rod displacement to avoid adding air to cylinder 150 during the piston downstroke.

A further variation within the principles of this invention includes using a valve (not shown) similar to valve 130 but no orifice therein. Operation of such a snubber with no orifice would be limited to the constant pressure mode described above with a similar small "dead band effect" variable by use of a spring between piston 152 and valve 158 as earlier mentioned.

FIG. 9 is a partial cross-sectional view of still another embodiment of a snubber 172 constructed according to the principles of this invention. Snubber 172 is quite similar to the snubber 132 described hereinabove with the primary difference therebetween being in the passageway communication between the upper end of cylinder 150 and the reservoir 126' and the valving arrangement therebetween. Accordingly, like elements will be designated by the same reference numerals and similar elements will be designated by the same reference numerals primed. Inasmuch as snubber 172 is identical to snubber 132 as set forth hereinbefore with the exception of the differences described hereinabove, FIG. 9 illustrates only such differences with the understanding that reference is to be made to FIGS. 5–8 for identical and similar features and positioning.

In snubber 172, portion 151 of cylinder 150 communicates with a passageway 123' which extends substantially horizontally outwardly (to the right as seen in FIG. 13). Passageway 123' communicates between portion 151 and the cavity of a reservoir 126' formed in a horizontally extending portion of the body member 148' and comprises: an inner portion 174; an intermediate portion 176 which has a diameter thereof larger than the diameter of portion 173 and receives an annular seating sleeve 177 therewithin and an enlarged diameter outer portion 178. The inner diameter of sleeve

177 is shown as being equal to the diameter of passageway portion 174.

The reservoir 126' is provided with a large horizontal bore 127' which extends through the outer wall of the reservoir 126' and is coaxial with bore 123'. A closure member 128' is sealingly secured within bore 127'. Closure member 128' has a circular seating portion 180 extending outwardly from the innermost end thereof. Portion 180 is of an outer diameter thereof substantially equal to the diameter of passageway portion 178 and is coaxial therewith. A cylinder 182 is positioned intermediate portions 178 and 180 and the respective axial ends thereof are seated within the portions 178 and 180. The outer diameter of cylinder 182 is substantially equal to the outer diameter of portions 178 and 180. A plurality of circumferentially spaced ports 184 extend radially through cylinder 182, are positioned intermediate the axial ends of cylinder 182 and communicate between the interior thereof and the cavity of the reservoir 126'.

A valve assembly 186 is received within cylinder 182. Valve assembly 186 comprises: a valve spring 188; a keeper member 190; and a spherical valve 192. Keeper member 190 has a generally stepped cylindrical configuration and compirses an inner portion 194 and a reduced diameter outer portion 196. Portion 196 has an outer diameter thereof substantially equal to the inner diameter of spring 188 and is received therewithin adjacent one end thereof. Portion 194 has a coaxial seat 198 formed within the inner surface thereof to provide a seating surface for valve 192. A plurality of bores 200 extend horizontally through keeper member 190.

Valve assembly 186 is positioned within cylinder 182 such that spring 188 has one end thereof seated on closure member seating portion 180. The length of spring 188 is such that the outer end thereof which has received keeper member portion 196 therewithin urges valve 192 into engagement with seating sleeve 177 thereby closing off the reservoir and the passageway 123' in a well known manner.

The general operation of snubber 172 is quite similar to the operation of the snubber 132 as described hereinbefore, however, when utilizing the snubber 172 it would be expected that such snubber would operate more efficiently than snubber 132. For example the fluid discharging from the passageway 123 into the cavity of snubber 132 could do so at a relatively high velocity thereby disturbing the air-oil interface and entraining air within the hydraulic fluid. After a period of time an accumulated air entrainment in the system of the snubber 132 could result in an air locked snubber. With an arrangement such as snubber 172 hydraulic fluid would overcome the bias of spring 188, flow through bores 200 into cylinder 182 and be discharged therefrom through ports 184 and into the cavity. The ports 184 are large enough to cut down the velocity of the discharging hydraulic fluid thereby decreasing the occurrences of air entrainment within the hydraulic fluid of the system.

An additional operating feature of the snubber 172 is that because the ports 184 provide a somewhat restricted path for the flow from cylinder 182 a back pressure within cylinder 182 will result thereby decreasing chattering (i.e., movement of valve 192 against adjacent surfaces). Such reduction of chattering decreases maintenance of the snubber for there is less wearing contact between adjacent surfaces. At this point it is to be noted that the diameter or number of ports 184 are determined by the necessity to have enough discharge area to maintain the velocity of discharging hydraulic fluid within an acceptable maximum while simultaneously providing a back pressure which is great enough to decrease chattering but not too great as to hamper the snubbing feature of the snubber 172. Still further the cooperation of sleeve 177 and seat 198 aid in maintaining valve 192 in a steady substantially non-chattering relative position. It is to be noted that it is comtemplated that sleeve 177 and keeper member 190 be made of a wear resistent material to withstand the continued frictional wearing thereof.

A further variation of snubber 172 within the principles of this invention includes using a valve 130 such as shown in snubber 132 which has an orifice therewithin. Operation of such a snubber would be essentially as described hereinbefore with reference to snubber 132.

The advantage of the snubber embodiments shown in FIGS. 5 through 9 resides almost completely in the characteristics of being able to be used in place of a normal pair of bolster springs with the attendant advantages as hereinbefore set forth.

Preferred embodiments of this invention having hereinbefore been described it is to be realized that variations in the structure embodying the principles of this invention without departing from the scope of such principles.

What is claimed is:

1. In a dampened railway truck assembly selectively operable in loaded and unloaded conditions and having a hydraulic snubber apparatus interposed in a spring group intermediate a bolster member and a side frame member, the improvement comprising: means interposed between said snubber apparatus and one of said members to bias said snubber apparatus towards the other of said members; said means being operative to bias said snubber apparatus out of operative engagement with said one of said members when said truck assembly is normally operating in an unloaded condition; and said means and said snubber apparatus being cooperable to initiate hydraulic snubbing by said snubber apparatus substantially only when said railway truck assembly is normally operating in a loaded condition, the bias of said means is partially overcome and said snubber apparatus is in operative engagement with both of said members.

2. In a railway truck assembly as specified in claim 1 wherein when said truck assembly is normally operating in an unloaded condition said snubber apparatus engages only said other of said members.

3. In a railway truck assembly as specified in claim 2 wherein when said truck assembly is normally operating in said loaded condition said snubber assembly is simultaneously in engagement with both of said members.

4. In a railway truck assembly as specified in claim 1 wherein said means biases said snubber apparatus into engagement with said other of said members.

5. In a railway truck assembly as specified in claim 1 wherein said snubber apparatus includes means biasing a portion of said snubber apparatus towards said one of said members.

6. In a railway truck assembly as specified in claim 1 wherein said means and said snubber apparatus replace a normal spring of said spring group.

7. In a railway truck assembly as specified in claim 1 wherein said one of said members is said bolster member and said other of said members is said side frame member.

8. In a railway truck assembly as specified in claim 1 wherein said one of said members is said side frame member and said other of said members is said bolster member.

9. In a railway truck assembly as specified in claim 1 wherein said snubber apparatus is interposed inwardly adjacent an outer peripherial portion of said spring group.

10. A railway truck snubber assembly comprising: a hydraulic snubber apparatus adapted to be interposed in a spring group intermediate a bolster member and a side frame member of a railway truck assembly; means in communication with said snubber apparatus and adapted to be interposed between said snubber apparatus and one of such members to bias said snubber apparatus towards the other of such members; said means being operative to bias said snubber apparatus out of operative engagement with such one of such members when such truck assrmbly is normally operating in an unloaded condition; and said means and said snubber apparatus being cooperable to initiate hydraulic snubbing by said snubber apparatus substantially only when such railway truck assembly is normally operating in a loaded condition. the bias of said means is partially overcome and said snubber apparatus is in operative engagement with both of such members.

* * * * *

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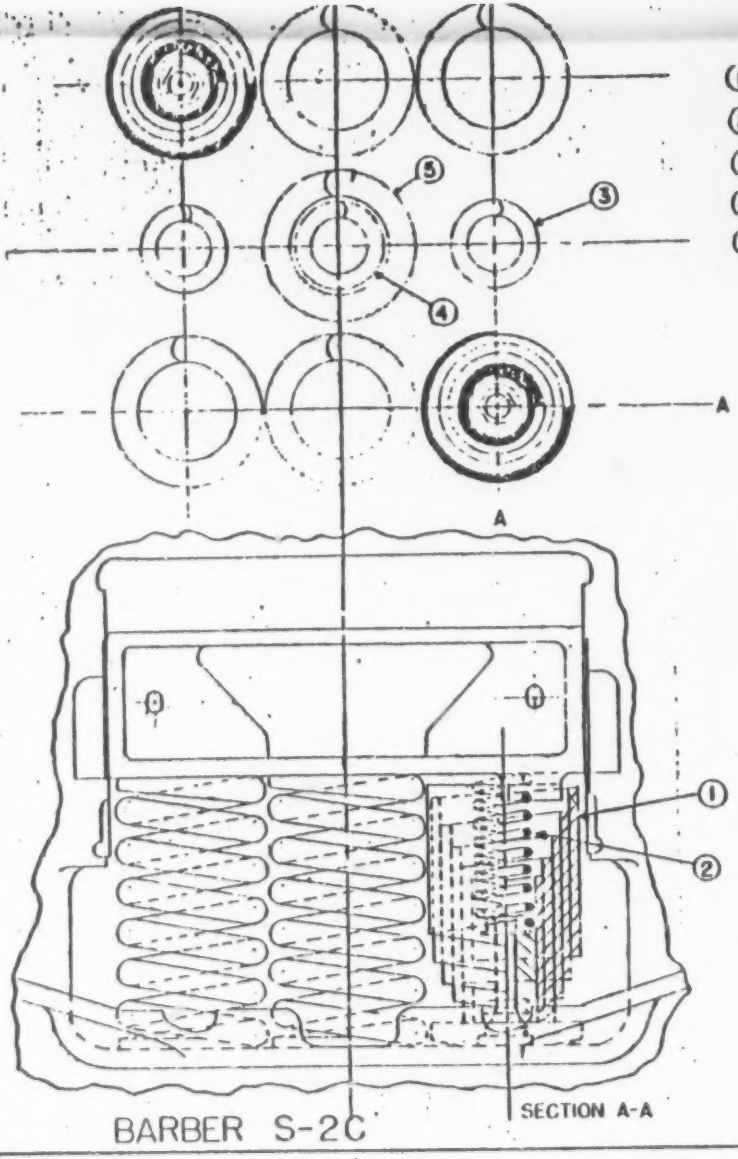
SHEET 3 OF 3

FIG. 6

FIG. 7

FIG. 5

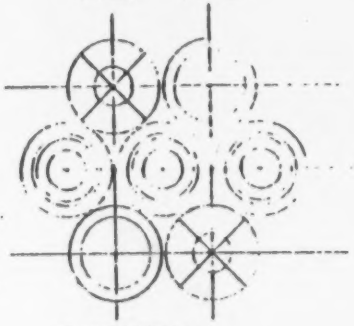
FIG. 8



	NO. REQ.	NAME	DRAWING NO.	FURNISHED BY
①	8	HOLLAND VOLUTE SNUBBER SPRING — E-2	B-206-C	HOLLAND CO.
②	8	ADAPTER SPRING 2.015" O.D. MAX. 6¼" F.H. 0.2253" BAR DIA.	B-332	"
③	8	BARBER SIDE SPRING		RAILROAD
④	4	INNER COIL SPRING A.A.R. D-5		"
⑤	20	OUTER COIL SPRING A.A.R D-5		"

R 409 HW

ASF A-3



5 OUTERS D-5
3 INNERS D-5
2 E-2 WITH SPRING

LIGHT CAR RIDING HEIGHT CONDITION

REF. — L.B.N.R.R. DRWG. NO. C-20790-H

PROPERTY OF
HOLLAND COMPANY
CHICAGO, ILL.

SPRING GROUP ARRANGEMENT
HOLLAND VOLUTE SNUBBER SPRING,
STYLE E-2, TO L.B.N.R.R. 80 TON
HOPPERS, NOS. 167,000-167,999

DATE	DRAWING No.	ISSUE
2/8/66	B-333	

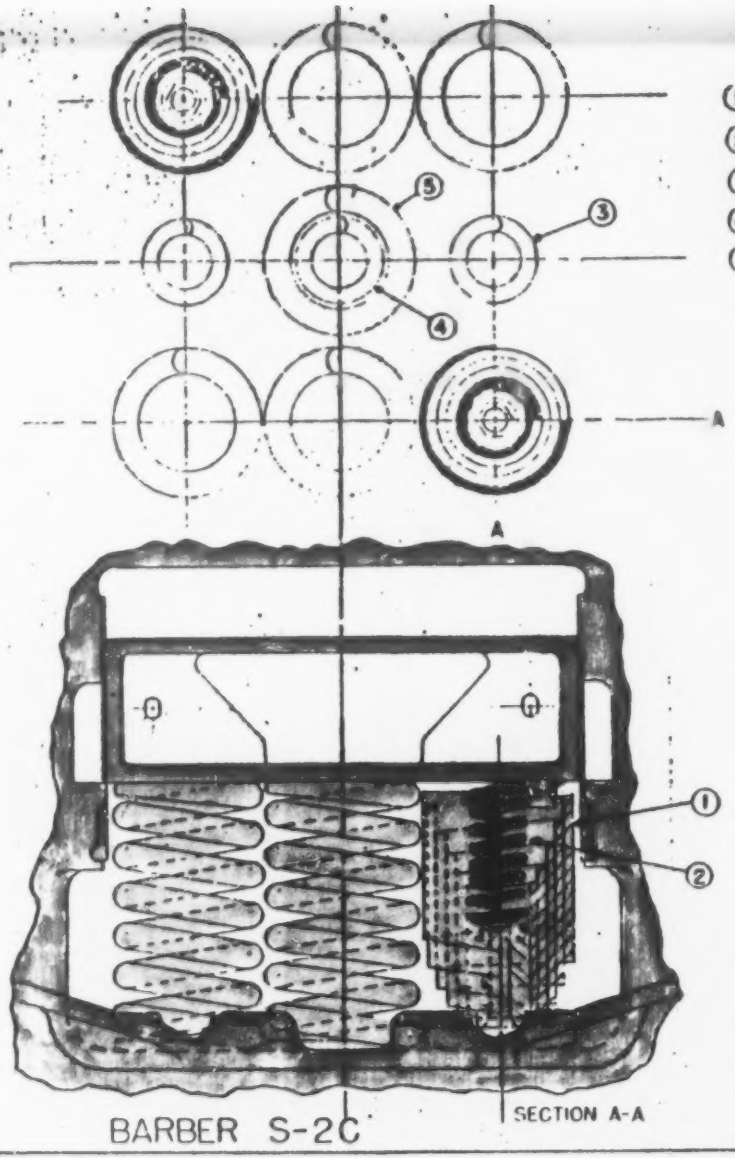
BY ASF | TR | CHK | APP'D EWM

PLAINTIFF'S EXHIBIT 409

BILL OF MATERIAL PER CAR SET

	NO. REQ.	NAME	DRAWING NO.	FURNISHED BY
①	8	HOLLAND VOLUTE SNUBBER SPRING — E-2	B-206-C	HOLLAND CO.
②	8	ADAPTER SPRING: 2.015" O.D. MAX. 6¼" F.H. 0.2253" BAR DIA.	B-332	"
③	8	BARBER SIDE SPRING		RAILROAD
④	4	INNER COIL SPRING A.A.R. D-5		"
⑤	20	OUTER COIL SPRING A.A.R D-5		"

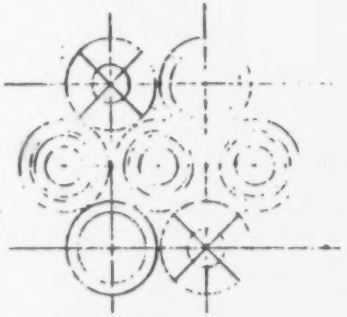
R 409 HW



BARBER S-2C

SECTION A-A

ASF A-3



5 OUTERS D-5
3 INNERS D-5
2 E-2 WITH SPRING

LIGHT CAR RIDING HEIGHT CONDITION

REF. — L.B.N.R.R. DRWG. NO. C-20790-H

PROPERTY OF
HOLLAND COMPANY
CHICAGO, ILL.

SPRING GROUP ARRANGEMENT
HOLLAND VOLUTE SNUBBER SPRING,
STYLE E-2, TO L&N R.R. 80 TON
HOPPERS, NO.S 167000-167,999

DATE	DRAWING No.	ISSUE
2/8/66	B-333	1

PLAINTIFF'S EXHIBIT 78

SPRING GROUP A

EACH SPRING GROUP TO CONSIST OF:
5 D-9 OUTER COIL SPRINGS
3 D-9 INNER COIL SPRINGS
2 HOLLAND R-2 SNUBBER SPRINGS
2 SPECIAL COIL SPRINGS

FOR APPLICATION OF SNUBBER RETAINING CLIPS SEE L & N DWG.

SPRING GROUP B

EACH SPRING GROUP TO CONSIST OF:
7 D-9 OUTER COIL SPRINGS
6 D-9 INNER COIL SPRINGS

SIDE CONTROL SPRINGS

SNUBBER

CORE DIA FOR RIVETS
CORE DIA FOR RIVETS

FRICTION PLATES ARE TO BE OILED TO SIDE FRAME CASTINGS AND IT IS RECOMMENDED THAT THE PROCEDURE OUTLINED ON DRAWING SHALL BE FOLLOWED

5'-0" SIDE BEARING CENTERS

IMPORTANT NOTE:
WHEN SNUBBERS ARE BROKEN OR MISSING FROM CAR REMOVE ALL SPRINGS FROM CAR AND REPLACE WITH CORRECT NUMBERS OF INNER AND OUTER COIL SPRINGS AS SHOWN IN SPRING GROUP B

SIDE FRAME
SIDE FRAME WEAR PLATE
ADAPTER
ROLLER BEARINGS
ROLLER BEARING ADAPTER
BRAKE BEAMS
BRAKE BEAM WEAR PLATES
TRUCK LEVER
TRUCK DEAD LEVER
DEAD LEVER GUIDE
BOTTOM CONNECTION
STUCK SIDE BEARING

SPRING TRAVEL

NOTE:
LIGHT CAR HEIGHT IS BASED ON RAIL LOAD OF 31,500 LBS.

NOTE
ROD LOWER LUG TO BE WELDED IN AS PER PAR. 84 STRIPED ON CARS.

NOTE
FOR CARS WITH GR. LOAD NOT EXCEEDING 220,000 LBS.

A-3

PLAINTIFF'S EXHIBIT 417

LOUISVILLE & NASHVILLE RR
LOUISVILLE, KY. MARCH 18, 1968
TRUCK NO 114-B
B-22228

UPDATE CHANGES

Dec. 4, 1934. W. F. KIESEL, JR. 1,983,088

RAILWAY CAR TRUCK

Filed Dec. 17, 1932

FIG. I.

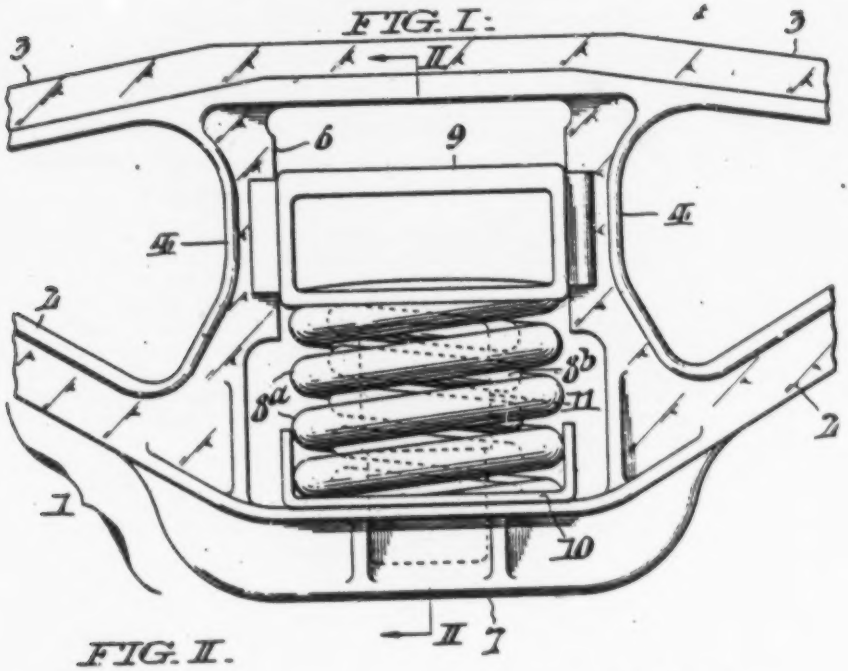


FIG. II.

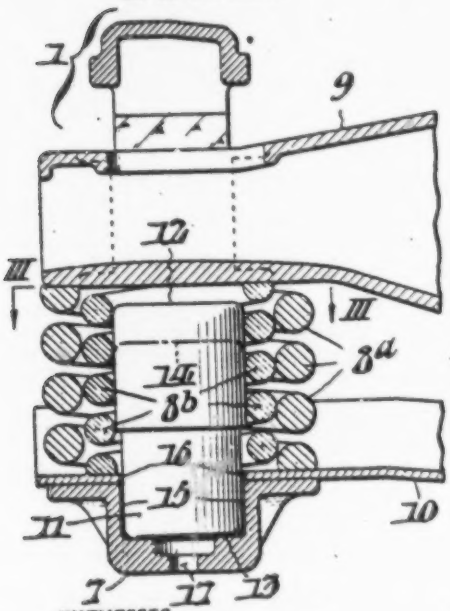
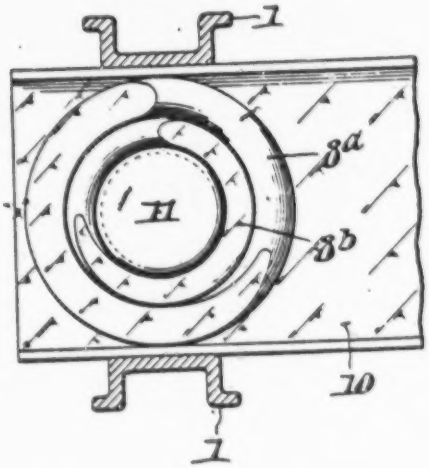


FIG. III.



WITNESSES:

Thomas W. Kerr Jr.

William Bell Jr.

INVENTOR:

William F. Kiesel, Jr.,

BY Fraser & Paul

ATTORNEYS.

PLAINTIFF'S EXHIBIT 27

Patented Dec. 4, 1934 1,983,088

UNITED STATES PATENT OFFICE

1,983,088

RAILWAY CAR TRUCK

William F. Kiesel, Jr., Hollidaysburg, Pa.

Application December 17, 1932, Serial No. 647,748

8 Claims. (Cl. 105—197)

This invention relates to railway car trucks, and more especially to the springs and associated parts by which the bolster of a car truck is supported within the truck side frames. Heretofore many schemes have been proposed for increasing the load carrying capacity of freight cars while maintaining easy riding qualities for the car body. Such schemes have for the most part involved radical changes in existing truck design.

The object of the present invention is to provide in a car truck a combination of shock absorbing means of differing characteristics which insures easy riding qualities for the car, under all conditions of loading, and wherein the arrangement is such as to require only a slight departure from present truck construction practice.

A further object of the invention is to provide in combination with the usual truck springs, or like resilient means for supporting the load carrying member, a shock absorbing device which is inactive under light loads, but which under heavy loads comes into play after a predetermined bolster deflection, and then serves adequately to support the load and to maintain proper riding qualities for the car.

A further object of the invention is to provide a truck side frame which in its general characteristics resembles side frames now in use, but which is designed to accommodate a shock absorbing device of greater solid height than the helical springs now customarily used.

Still other objects and advantages characterizing my invention will become more fully apparent from the description hereinafter set forth of one embodiment or example of the practice of the invention, the description having reference to the accompanying drawing. Of the drawing:

Fig. I represents a side elevation of a portion of a side frame of a railway car truck embodying my invention.

Fig. II represents a vertical cross section of the same, taken as indicated by the lines II—II of Fig. I; and,

Fig. III represents a horizontal cross section of the same, taken as indicated by the lines III—III of Fig. II.

With reference to the drawing, there is shown a truck having side frames 1 of a common construction, each side frame including tension members 2 and compression members 3. Guide columns 4 define a window 6 at the center of the side frame. The tension members 2 include a spring seat portion 7 upon which helical springs 8a, 8b are mounted. In the present example of my invention, an outer helical spring 8a and an inner helical spring 8b, arranged in concentric relation, are employed. A bolster 9 of customary form is supported at its ends upon the helical springs 8a, 8b, the bolster having capacity for vertical movement within the window 6 of the side frame, and being guided by the guide columns 4. A spring plank 10 joins one side frame 1 with the corresponding side frame at the opposite side of the truck. Each end of the spring plank 10 rests directly upon the spring seat portion 7 of the tension members 2 of the side frame.

For the purpose of adequately supporting the bolster 9 under heavy load conditions, there is provided in addition to the helical springs 8a, 8b a shock absorbing device 11, which may comprise upper and lower movable elements 12, 13 and which may take a great variety of forms. There are many well-known types of snubbers useful for this purpose, and the particular construction of the shock absorbing device 11 forms no part of this invention.

In its normal free position, the shock absorbing device 11 assumes the position shown in Fig. II. The solid height of the shock absorbing device is represented by the dot-and-dash line at 14. It will be apparent that the solid height of the shock absorbing device 11 is greater than the solid height of the helical springs 8a, 8b. In order to accommodate a shock absorbing device having the desired initial free position, the desired capacity, and the desired solid height, the side frame 1 is provided with a depression 15 in the seat portion 7 of the tension members 2. The depression 15 extends downward substantially below the top wall of the seat portion 7 and is constructed in such manner as to accommodate the base 13 of the shock absorbing device with a snug fit. Moreover, in the spring plank 10 there is an opening 16 conforming to the opening at the mouth of the depression 15, and hence the shock absorbing device 11 also serves as a locking pin maintaining the spring plank in proper relation with the seat member 7 of the side frame. Leading downward from the depression 15 through the bottom of the seat portion 7 of the tension members 2, there is an opening 17 useful for the purpose of removing the shock absorbing device 11.

According to the preferred arrangement, the helical coil springs 8a, 8b are arranged in concentric relation with each other as well as in

concentric relation with the shock absorbing device 11. However, various other arrangements of the coil springs can obviously be used and are within the contemplation of this invention.

In operation the shock absorbing device 11 functions in the following manner. Under empty car weight the helical coil springs 8a, 8b carry the entire load, and there is clearance between the bottom of the bolster 9 and the top of the shock absorbing device 11. When there is added to the static weight of the car body approximately one quarter of the car load capacity, the bolster engages the top of the shock absorbing device 11; and with heavier loads the shock absorbing device 11 cooperates with the helical coil springs 8a, 8b to give the desired easy riding qualities to the car. Even under excessive loads, the shock absorbing device 11 is of such capacity and of such solid height as to prevent the springs 8a, 8b from going solid, and accordingly even under excessively heavy loads there is still a yielding support for the bolster 9.

The preferred manner of assembling and disassembling the combination of springs and shock absorbing means described above is as follows. The trucks are assembled in inverted position. This is accomplished by inverting the bolster 9 and the side frame 1, then stripping the side frames over the ends of the bolster 9 and dropping the bolster into proper engagement with the guide columns 4 at the windows 6 of the side frames. The helical springs 8a, 8b with the shock absorbing devices 11 assembled centrally thereof, are then introduced above the inverted bolster, after which the spring plank 10 is placed on top of the springs and the shock absorbing device. During this operation wedges, bearings, and axles with wheels thereon, have also been put in place. The truck is then turned over into its normal running position.

When, due to the wear of wheels, bearings, or other parts, it becomes necessary to raise the bolster to bring the car coupler back to its normal position, shims may be introduced between the top of the springs 8a, 8b and the bottom of the bolster 9. As the truck of the present invention is thus assembled, the shock absorbing device 11 expands into the depression 15 at the seat portion 7 of the tension members 2, and forms a secure lock between the side frame 1 and spring plank 10. Moreover, the helical springs 8a, 8b are held by the shock absorbing device 11 against sidewise displacement and cannot be separated from each other.

When it is desired to remove the springs 8a, 8b, or the shock absorbing device 11 while the truck is beneath the car, this can be done in the usual manner by jacking up the bolster 9 until it comes in contact with the top chord formed by the compression member 3 of the side frame. The elements of the shock absorbing device 11, as well as the springs 8a, 8b, may then be removed by first applying a bar through the opening 17 beneath the depression 15 to raise the shock absorbing device above the level of the spring plank 10, and then shifting the spring assembly laterally across the window 6 of the side frame 1.

While I have described one particular example of the practice of my invention, it will be apparent that various changes may be made as to the form and arrangement of the springs, shock absorbing device, and associated parts without departing from the spirit of my invention as defined in the annexed claims.

Having thus described my invention, I claim:

1. In a railway car truck, the combination of a side frame, having a depression in the seat portion thereof, said depression extending downward through and below the upper web of the seat portion, a load carrying member, resilient means for supporting the load carrying member on the seat portion of said side frame, and a shock absorbing device disposed vertically for travel between said load carrying member and the base of said depression, said shock absorbing device being of a greater solid height than that of said resilient means.

2. In a railway car truck, the combination of a side frame, having a depression in the seat portion thereof, said depression extending downward through and below the upper web of the seat portion, a load carrying member, resilient means for supporting the load carrying member on the seat portion of said side frame, and a shock absorbing device adapted to be engaged by said load carrying member, said shock absorbing means being disposed adjacent to said resilient means with its base fitting snugly within the depression aforesaid.

3. In a railway car truck, the combination of a side frame, having a depression in the seat portion thereof, said depression extending downward through and below the upper web of the seat portion, a spring plank resting on said seat portion of the side frame and having an opening therein conforming to said depression, a bolster, resilient means on said spring plank above the seat portion of the side frame for supporting the bolster, and a shock absorbing device for said bolster comprising relatively movable elements disposed vertically adjacent to said resilient means with the lower element fitting snugly within the opening in said spring plank and within the depression in the seat portion of said side frame, and serving as a pin locking the spring plank to said seat portion.

4. In a railway car truck, the combination of a side frame, having a depression in the seat portion thereof, said depression extending downward through and below the upper web of the seat portion, a load carrying member, resilient means for supporting the load carrying member on the seat portion of said side frame, and a shock absorbing device comprising relatively movable elements disposed vertically between said load carrying member and the base of said depression with the lower element fitting snugly within said depression, said shock absorbing device being of a greater solid height than that of said resilient means.

5. In a railway car truck, the combination of a side frame having a tension member affording a spring seat and having a depression in the seat portion of said tension member extending downward through and below the upper web of the tension member, said tension member having an opening leading from said depression through its bottom wall, a bolster, springs for supporting said bolster on the seat portion of said tension member, and a shock absorbing device having its base seated in said depression above the opening aforesaid, said shock absorbing device being adapted to support the bolster when the same is heavily loaded.

6. In a railway car truck, the combination of a side frame having a tension member affording

a spring seat and having a depression in the seat portion thereof, a bolster, said depression extending downward through and below the upper web of the seat portion, a helical spring for supporting said bolster on the seat portion of said tension member, and a shock absorbing device disposed vertically between said bolster and the base of said depression in concentric relation within said spring.

7. In a railway car truck, the combination of a side frame having a tension member affording a spring seat and having a depression in the seat portion thereof, a bolster, said depression extending downward through and below the upper web of the seat portion, concentric helical springs for supporting said bolster on the seat portion of said tension member, and a shock absorbing device disposed vertically between said bolster and the base of said depression in concentric relation within said concentric springs.

8. A side frame for a railway car truck having a tension member affording a spring seat, having a centrally positioned depression in the seat portion thereof for accommodating the base of a shock absorbing device, said depression extending downward to the bottom wall of the tension member, and having an opening leading from said depression through the bottom wall of said tension member, through which opening access may be had to the base of said shock absorbing device.

WILLIAM F. KIESEL, Jr.

Dec. 4, 1934. W. F. KIESEL, JR 1,983,088

RAILWAY CAR TRUCK

Filed Dec. 17, 1932

FIG. I.

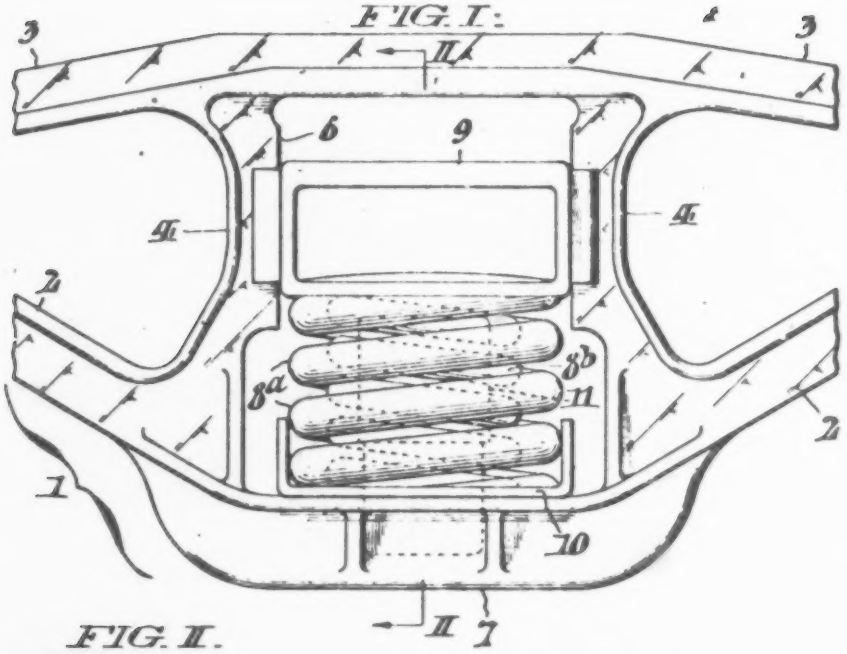


FIG. II.

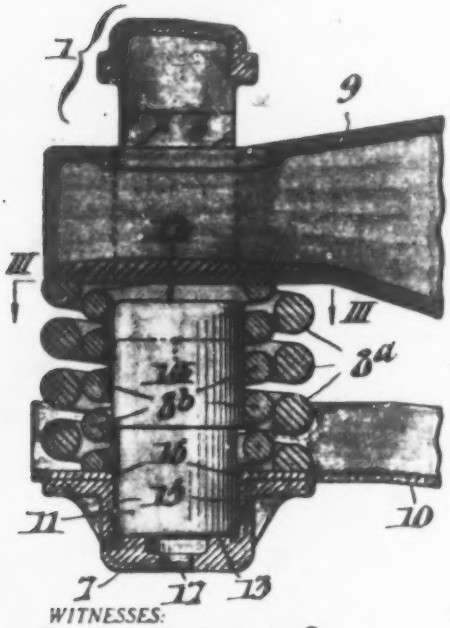
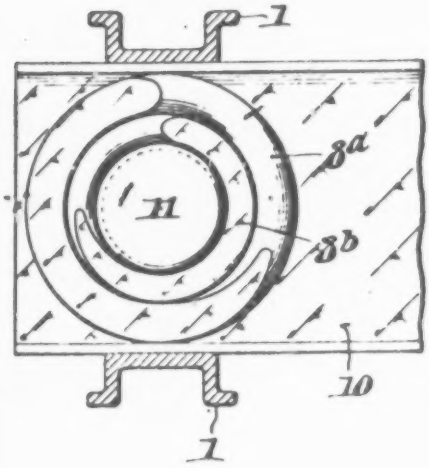


FIG. III.



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PLAINTIFF'S EXHIBIT 79

4

Jan. 29, 1935. T. H. SYMINGTON 1,989,433

SNUBBED TRUCK SPRING

Filed July 1, 1930

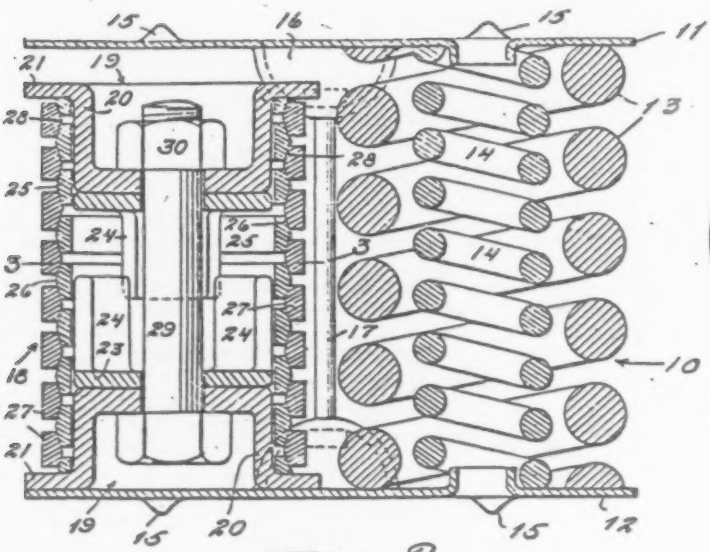


Fig. 2.

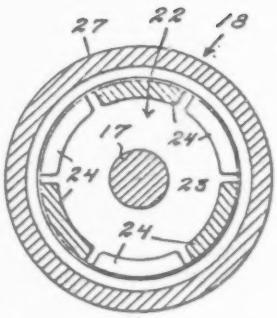


Fig. 3.

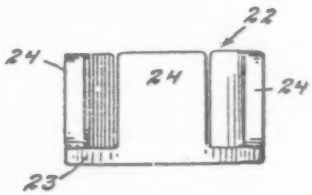


Fig. 4.

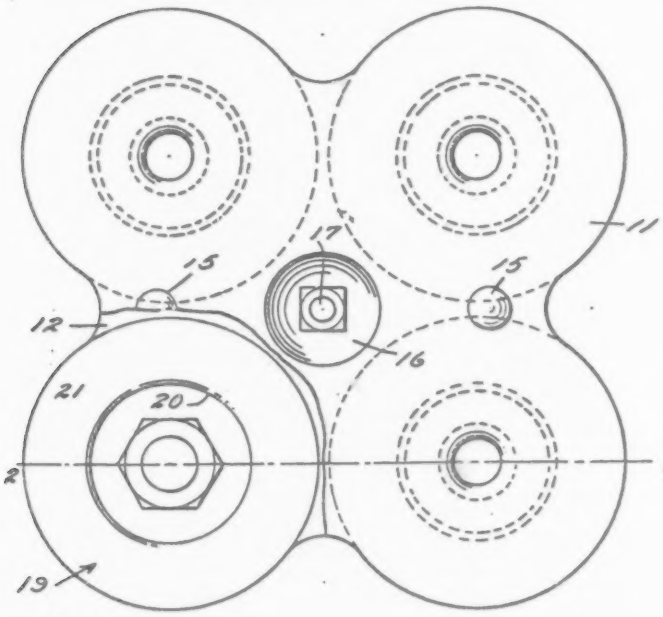


Fig. 1

Inventor

Thomas H. Symington

By John Milton Jester

PLAINTIFF'S EXHIBIT 60

Patented Jan. 29, 1935

1,989,433

UNITED STATES PATENT OFFICE

1,989,433

SNUBBED TRUCK SPRING

Thomas H. Symington, Baltimore, Md., assignor to T. H. Symington & Son, Inc., Baltimore, Md., a corporation of Maryland

Application July 1, 1930, Serial No. 465,182

14 Claims. (Cl. 267—4)

The invention relates to railway truck spring suspension.

It is well known that the ordinary means for supporting the truck bolster in a railway car truck comprises a group or nest of helical springs, the number and capacity of which necessarily varies in accordance with the character of the car. The springs in any group or nest are customarily of the same height, travel and capacity. A great difficulty has been that a spring assembly capable of properly sustaining the maximum load is too stiff to provide proper resilience under no load or light load conditions. Conversely, a spring suspension which will act satisfactorily under light load conditions will go solid and fail to function under maximum load conditions. The problem has consequently arisen as to the obtaining of a proper balance. Furthermore, as the ordinary springs have the same characteristics they also have the same period of vibration, the result being that oscillations starting for instance by passage of the wheels over rail joints or low spots in the track build up when the spring deflections become synchronized with the passage of the wheels over rail joints, etc., and this cumulative action may even cause derailment of the truck.

It is with all of the above facts in view that I have devised the present invention which has for its general object the provision of a spring assembly including spring units of ordinary type combined with a friction producing means adapted to come into play upon partial deflection of the standard springs for absorbing shocks and providing the proper cushioning effect under heavy load conditions, the usual springs performing their function satisfactorily under light load conditions.

An important object of the invention is to provide a shock absorbing suspension mechanism in which one or more of the ordinary springs may be simply replaced by friction producing units.

Another object of the invention is to provide a mechanism of this character in which the friction producing means is of less height and travel than the ordinary helical springs so that the spring and friction means will operate sequentially and then simultaneously.

Another object of the invention is to provide an assembly in which the free or live standard springs are assisted under heavy load conditions by a combined spring and friction producing means having high absorption capacity, the standard helical springs being thereby relieved of strain which might otherwise cause them to go solid.

Another object of the invention is to provide an absorption unit embodying a combination of friction producing elements and spring elements arranged and mounted in cooperating relation, this unit being capable of employment to replace a helical spring in a standard spring nest so that the ultimate capacity of the entire assembly may be quickly increased.

Another important object of the invention is to provide a cushioning means embodying an absorption unit in which the combined spring and friction producing means may be lubricated and maintained in such condition without the provision of any auxiliary housing or the like, the purpose being to prevent any unnecessary wear on the parts so that their life will be prolonged.

Another object of the invention is to provide an absorption unit having an ultimate capacity many times that of what will be required of it even in the most strenuous service so that the elements will not be subjected to any undue fiber stresses and will therefore be free from excessive strains and not liable to breakage, stretching or other distortion.

To the attainment of the foregoing and other objects and advantages, the invention preferably consists in the details of construction and the arrangement and combination of parts to be hereinafter more fully described and claimed, and illustrated in the accompanying drawing in which:

Figure 1 is a plan view of a spring nest with a portion of the top cap broken away to show a plan view of the novel friction producing or absorption unit,

Figure 2 is a vertical cross sectional view taken on the line 2—2 of Figure 1.

Fig. 3 is a detail cross section taken on the line 3—3 of Figure 2,

Figure 4 is a detail elevation of one guide member.

Referring more particularly to the drawing it will be observed that I have disclosed a spring nest, group or assembly indicated as a whole by the numeral 10 and comprising upper and lower spring plates or caps 11 and 12 between which is a plurality of spring units which may be of the single or double coil type, as preferred, but which are here represented as including outer coils 13 and inner coils 14. This assembly or nest is of course intended to be mounted in the window opening of a side frame in the usual manner and the spring plates or caps are therefore shown as having the usual tits or projections 15 thereon adapted to enter holes or recesses in the bottom of the window opening and the underside of the bolster so that the nest will be retained in place.

As is customary, the spring plates or caps have depressed central portions 16 extending toward each other and connected by a tie bolt 17 for holding the parts assembled prior to installation in a truck. In the present instance the nest is shown as of the four unit type but it will be distinctly understood that this is simply for purposes of illustration as it is well known that higher capacity cars are equipped with spring nests embodying a larger number of units.

In carrying out my invention I provide an absorption mechanism formed as a complete and separate unit or entity and indicated as a whole by the numeral 18, this unit being intended to replace one of the spring units. It is of course apparent that more than one absorption unit may be used if preferred though ordinarily one is probably sufficient.

The friction producing unit 18 is here disclosed as comprising similar or counterpart upper and lower caps 19 which may be formed as drop forgings, stampings or the like but which are preferably the former. Each of these caps includes a cylindrical portion 20 terminating at one end in an outstanding flange 21, and the two flanges are arranged adjacent the upper and lower spring caps as clearly indicated, the lower cap being preferably spot welded or otherwise secured to the lower cap 12. It is intended that these caps engage and confine between them the combined spring and friction producing means and as this means comprises a plurality of coacting elements, the cylindrical portions 20 of the caps constitute guides. However, as there is considerable space between the adjacent ends of the caps it becomes necessary to provide other guide means and this may be readily accomplished by arranging between the caps a pair of guide members 22 which may likewise be formed as pressings or stampings but which are preferably drop forgings spot or otherwise welded to the caps. It is even conceivable that these guides 22 might be formed integrally of the caps, this being considered a very minor detail. Each of the guides is represented as including a circular or disk-like horizontal portion 23 from which extend lugs or fingers 24, these fingers on the two guide members interfitting as clearly indicated in Figure 2 and being of such length as not to interfere with relative movement of the caps 19 toward each other, or more precisely, downward deflection of the unit, to the maximum extent desirable. While spot welding is referred to as the means or method of connecting the guide members 22 with the caps 19 it is conceivable that some other securing means might be resorted to if ascertained to be advantageous.

The resilient friction producing means is shown as comprising an inner series of spring rings 25 spaced apart and surrounding the cylindrical portions 20 of the caps and also surrounding the assembled interfitting fingers 24. These inner rings are of double frusto-conical shape, that is to say their outer peripheries are tapered off or reduced gradually in diameter from the center toward both ends so as to provide inclined friction faces 26. Located outwardly of and coacting with the rings 25 and located opposite the spaces therebetween and in overlapping relation thereto are outer spring rings 27 which have their inner peripheries flared outwardly from the center toward both ends or edges and corresponding to the taper or inclination of the inclined faces 26, these inclined faces on the outer series of rings being indicated at 28.

The intention is that the friction unit 18 be put in the first place under a certain initial compression so that under light load conditions the weight of the car and its lading will be borne by the standard spring units. This means that the friction unit is not to become operative until the load on the nest exceeds a certain predetermined limit. As a consequence it is intended that the top of the friction unit be spaced somewhat below the upper cap of the nest in order that it will not be engaged thereby to energize the friction unit until the predetermined load has been exceeded. To bring this about is really a very simple matter and to accomplish it I preferably provide a tie bolt 29 which passes through the caps 19 and through the centers of the disk portions 23 in the guide members 22.

In actual practice under the A. R. A. standard the free height of the helical springs in a nest such as that disclosed is 8¼ inches. As mentioned above it is intended that the nut 30 on the tie bolt 29 be screwed down to reduce the free height of the friction unit 18 so that the helical springs may be compressed for a portion of their travel before the friction unit becomes effective. However, the exact degree of the initial compression of the friction unit is a matter which depends upon different circumstances, that is to say number of helical springs in the unit, the capacity of the nest, the character of the car and the lading to be carried thereby, etc. No dimensions or no relative proportions of the normal height of the friction unit with respect to the free height of the helical springs are given as it is easily conceivable that there may be considerable variations brought about to suit different requirements by the very simple expedient of adjusting the nut 30 which is, however, not intended to be shifted after the unit is set for a certain definite installation. Springs or spring rings of the type shown at 25 and 27 and arranged in a manner such as that disclosed are capable of withstanding a tremendous pressure, the total capacity of a unit built up from the number of elements shown being in the neighborhood of 82,000 pounds which is far more than the unit will ever be called upon to withstand, it being probable that the load will not exceed one-half of this amount. In general practice it is very likely that an initial compression of 4,000 or 5,000 pounds, brought about by the tie bolt 29, will be entirely sufficient to reduce the free height of the friction unit to a point where the helical springs may have the desired travel before the friction unit becomes effective so that the latter may operate as a reserve cushioning means for snubbing any further compression of the helical springs.

In the operation, it will be seen that under light or moderate load conditions the weight is borne by the helical springs. However, when there is any tendency for the helical springs to go solid, either as the result of overloading or insufficient capacity thereof, or as the result of vertical jiggle of the truck bolster, such as results from synchronization of vibration of the helical springs with passage of the car wheels over rail joints, low spots, etc., the upper spring cap will engage upon the upper cap 19 of the absorption unit and will exert a strong downward thrust upon the inner and outer series of rings 25 and 27. Owing to the fact that the inner rings have frusto-conical outer peripheries and the outer rings have the correspondingly tapered or inclined inner peripheries, there is a wedging action, there being a compressive force exerted radially inwardly upon

the inner rings and an expansive force exerted radially outwardly upon the outer rings. Though these rings are continuous they are of spring material and may consequently yield to a limited extent when subjected to very high pressures. Actually there is no great movement of the respective series of rings either inwardly or outwardly though the former can be compressed and the latter stretched slightly. The resistance of these springs to the compressive or expansive force provides resilience of high capacity and at the same time the tendency of the springs to be moved axially results in the development of a high degree of friction between the contacting cooperating tapered or inclined surfaces 26 and 28. This combination of resilience and friction will render this entire unit most advantageous for taking care of overloading of the standard springs in the nest and particularly for snubbing any jiggling movement which may develop. This latter mentioned function is particuarly true as it is obvious that the natural period of vibration of the friction unit 18 is entirely different from that of the standard or helical coil.

If it is so desired, in order to reduce wear or unnecessary wear on the coacting parts, it is a simple matter to pack the interior of the unit 18 with some suitable lubricant inasmuch as the contacting rings 25 and 27 being in close engagement constitute, in effect, a housing which will act to retain the lubricant and prevent it from becoming lost.

From the foregoing description and a study of the drawing it will be apparent that I have thus provided an extremely simple, easily assembled and installed and highly efficient cushioning mechanism for railway car truck bolsters or the like and one in which adequate means has been provided for tremendously increasing the total capacity without requiring entirely new equipment, as the desirable results are achieved by the mere replacement of one of the ordinary spring units with a combined spring and friction unit capable of fulfilling all the functions required of it. It is believed that the construction, operation, and advantages should be readily apparent to one skilled in the art without further explanation.

While I have shown and described the preferred embodiment of the invention, it should be understood that the disclosure is merely an exemplification of the principles involved as the right is reserved to make all such changes in the details of construction as will widen the field of utility and increase the adaptability of the device provided such changes constitute no departure from the spirit of the invention or the scope of the claims hereunto appended.

Having thus described the invention, I claim:

1. A railway car truck spring assembly comprising the combination of a plurality of coil springs of A. R. A. standard character and free height, and a special unit of less normal height, the special unit being energized sequentially with respect to the standard springs and then simultaneously therewith under increasing load conditions, said special unit comprising series of respectively laterally compressible and expansible elements and means for energizing the same.

2. A railway car truck spring assembly comprising the combination of a plurality of coil springs of standard free height, and a special unit of less normal height, the special unit being energized sequentially with respect to the standard springs and then simultaneously therewith under increasing load conditions, said special unit comprising a series of laterally compressible spring members and a series of laterally expansible spring members having a wedging relation.

3. A railway car truck spring assembly comprising the combination of a plurality of coil springs of standard free height, and a special unit of less normal height, the special unit being energized sequentially with respect to the standard springs and then simultaneously therewith under increasing load conditions, said special unit comprising a series of laterally compressible spring members and a series of laterally expansible spring members having a tapered interfitting relation.

4. A railway car truck spring assembly comprising the combination of a plurality of standard helical spring units operating to support loads up to a predetermined limit, and a special unit arranged to operate simultaneously with said helical springs beyond said predetermined limit, said special unit embodying coacting series of frictionally engaged concentric spring members maintained under initial compression.

5. A spring assembly comprising a plurality of helical springs and a special unit embodying inner and outer spring rings having wedging engagement, and means for maintaining said special unit under initial compression.

6. A spring assembly comprising a plurality of helical springs and a special unit embodying inner and outer spring rings having wedging engagement, means for maintaining said special unit under initial compression, comprising caps at the ends of the series of spring rings, and means connecting the caps.

7. A spring assembly comprising a plurality of helical springs and a special unit embodying inner and outer spring rings having wedging engagement, means for maintaining said special unit under initial compression, comprising caps at the ends of the series of spring rings, and means connecting the caps, said spring rings contacting closely and cooperating to define a substantial housing for containing lubricant.

8. A railway car truck spring assembly comprising upper and lower caps with a plurality of interposed standard height helical springs, and a special unit interposed between the caps, said special unit comprising a pair of end caps, an inner series of spring rings located between the end caps, an outer series of spring rings, and tie means connecting the end caps for holding said special unit under initial compression, said inner and outer rings having wedging engagement.

9. A railway car truck spring assembly comprising upper and lower caps with a plurality of interposed standard height helical springs, and a special unit interposed between the caps, said special unit comprising a pair of end caps, an inner series of spring rings located between the end caps, an outer series of spring rings, and tie means connecting the end caps for holding said special unit under initial compression, said inner and outer rings having their outer and inner peripheries respectively oppositely tapered from their centers to define coacting frusto-conical portions for exerting a wedging action and developing friction during closure of the unit.

10. A spring assembly comprising a plurality of helical springs and a special unit embodying a series of inner and a series of outer continuous spring rings having wedging engagement and spaced apart axially, caps at the ends of said unit, tie means connecting the caps, and guide means located between the caps and within the inner spring rings.

11. A spring assembly comprising a plurality of helical springs and a special unit embodying a series of inner and a series of outer continuous spring rings out of contact axially having wedging engagement radially, caps at the ends of said unit, tie means connecting the caps, and guide means located between the caps and within the inner spring rings in spaced relation thereto, said guide means having interfitting relation.

12. An absorption unit comprising outer and inner continuous spring rings spaced apart longitudinally and contacting laterally, caps upon the ends thereof, tie means connecting the caps, and guide members located between the caps and within the inner spring member in spaced relation to the latter.

13. An absorption unit comprising outer and inner series of continuous spring rings spaced apart longitudinally and contacting laterally, caps upon the ends thereof, tie means connecting the caps, and guide members located between the caps and within the inner spring member, said guide members having interfitting relation with each other and being spaced from the inner periphery of the inner rings, said caps being spaced from the endmost outer rings and contacting with the endmost inner rings.

14. An absorption unit comprising outer and inner spring members, caps upon the ends thereof, a tie bolt connecting the caps, and guide members located between the caps and within the inner spring member, said guide members being formed as disks covering the innermost portions of the caps apertured for close engagement upon the tie bolt and formed with alternately arranged interfitting fingers.

THOMAS H. SYMINGTON.

267. SPRING DEVICES

4

Search Room

E-26

Jan. 29, 1935. T. H. SYMINGTON 1,989,433

SNUBBED TRUCK SPRING

Filed July 1, 1930

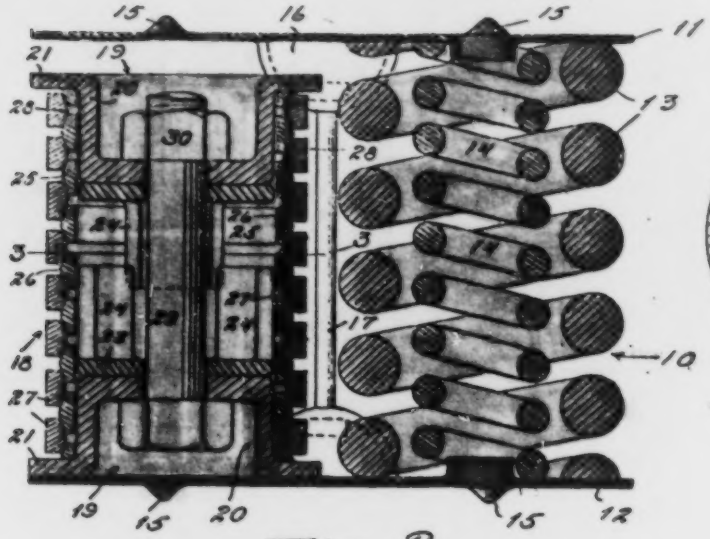


Fig. 2.

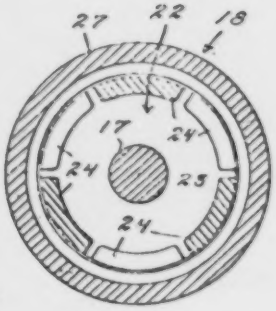


Fig. 3.

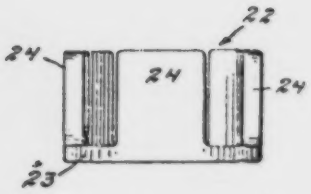


Fig. 4.

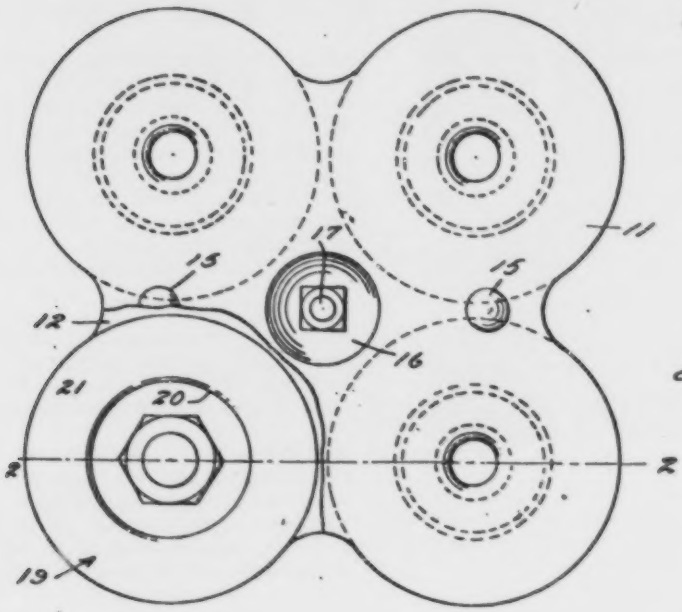


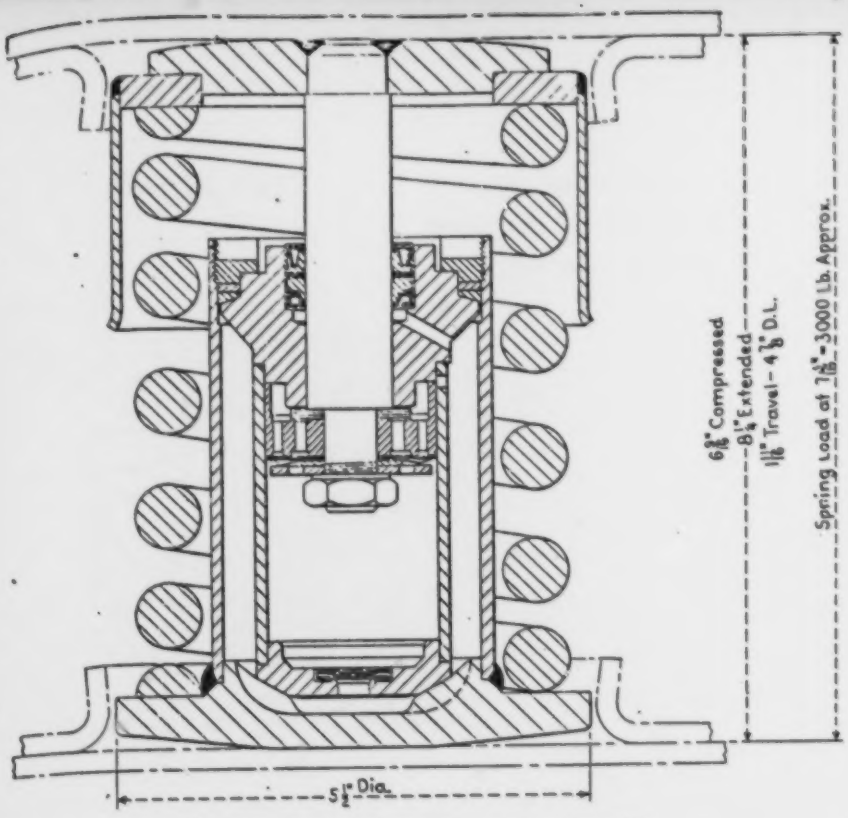
Fig. 1

Inventor

Thomas H. Symington

By John Milton Jester

PLAINTIFF'S EXHIBIT 80



A Cross Section of the Shock-Absorber Unit

Shock Absorber for Freight Cars

Based on experience gained in equipping a large percentage of all railroad passenger cars built since 1936 with hydraulic shock absorbers and a notable record as manufacturers of shock absorbers for U. S. tanks, jeeps, scout cars and heavy trucks, the Monroe Auto Equipment Company, Monroe, Mich., has recently announced the development of a new hydraulic shock absorber for freight cars. Specific objectives sought in the development of this device are uniformly dependable performance in cushioning shocks to lading and car structures; quiet, efficient action; long life, and general freedom from the necessity of servicing.

The new hydraulic shock absorber is a small, compact and self-contained unit which replaces one conventional truck spring in the spring cluster supporting each end of the truck bolster. It offers hydraulic resistance to the compression movements and contains an external spring which carries part of the load imposed by the weight of the car and also returns the shock absorber to its original position. Hydraulic resistance inside the pressure chamber is controlled by a series of spring-steel discs used in conjunction with a predetermined metered orifice. The control can be varied to meet any required conditions by using the proper combination of orifice and pressure relief. The pressure chamber is surrounded by a large oil-reservoir chamber to compensate for the displacement of the piston rod.

The Monroe Hydraulic Shock Absorber Replaces One Oil Spring in Each Bolster Spring Cluster

In operation, oil passes from the reserve to the pressure chamber through a non-return valve in the lower part of the pressure chamber. The unit is a sealed assembly at the lower end so there can be no leakage at this point, and the upper end is sealed with synthetic rubber seals. The oil used is said to assu uniform action under all temperatu and weather conditions encountered normal railway operation.

Another development of this compa is a stabilizer designed to minimize t swaying of freight cars caused by tra irregularities or curves. This devi consists primarily of a torsion bar e tending across each truck and connect between the bolster and truck frame such a way that any tendency of the c body to rock on the truck centers is r sisted by torsion in the car. This ty of device has demonstrated its value passenger service.

This company has also effected a nu ber of improvements in passenger-c hydraulic shock absorbers. The mo fied shock absorbers are said to be light and more economical, both in origin cost and in use. Higher pressures a possible because of closer tolerances ar improve[illegible] the pressure char ber, sha[illegible] val seats.

PLAINTIFF'S EXHIBIT 68

NEW

The Modern Gas Turbine. By R. To Sawyer. Published by Prentiss-Hall, In 70 Fifth avenue, New York. 250 page 6 in. by 9 in., 131 illustrations. Pri $4.00.

The gas turbine has been very much in t limelight during the past three or fo years and yet because of the war much the development work during that perio has either been done without any gre amount of publicity or has mainly been th subject of papers before technical societie The gas turbine, in its several forms, ap pears to have great possibilities in the fu ture and there is considerable curiosity con cerning its principles and applications bot on the part of the layman and the enginee in industry.

With the idea of satisfying the needs o both these groups the author of this non technical work has co-ordinated the avail able data on the subject into a book that i well organized and extremely readable From the opening chapters dealing with historical background, through chapter which present the fundamentals of princi ples and design and on into that part deal ing with the many practical applications o the gas turbine, the author has kept in mind the diversity of interests of the reade to such an extent that irrespective o whether he be in railroad, marine, public utility or aeronautical work his questions will find an answer.

Of particular interest to the railroad man is the chapter on the gas-turbine locomotive. In it are discussed the existing applications, both in this country and Europe, of the gas turbine as a supercharger for Diesel engines and as a prime mover. Design and performance data are included that enable the reader to make comparisons with existing types of railroad motive power and to lay a groundwork of knowledge of the subject that will be valuable in appraising future developments.

Nov. 16, 1937. D. F. SPROUL 2,099,240

BOLSTER SUPPORTING UNIT

Filed Dec. 31, 1934

Fig. 1

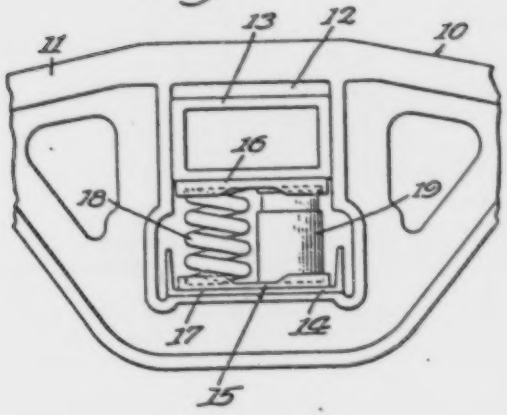


Fig. 3

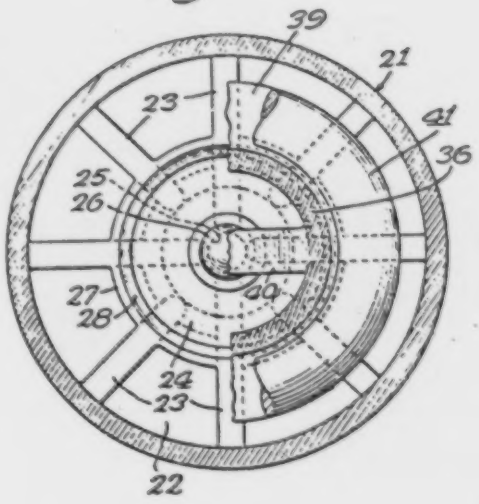


Fig. 2

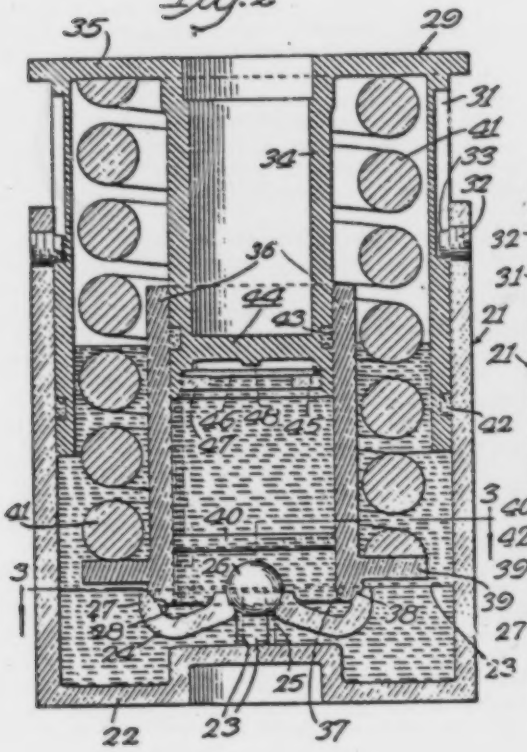
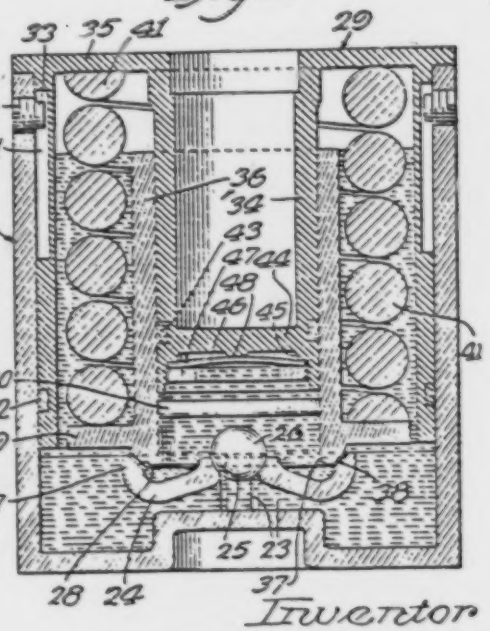


Fig. 4



Inventor

Donald F. Sproul

By Gillson, Mann & Gillson Attys

PLAINTIFF'S EXHIBIT 61

Patented Nov. 16, 1937 2,099,240 E-29

UNITED STATES PATENT OFFICE

2,099,240

BOLSTER SUPPORTING UNIT

Donald F. Sproul, Chicago, Ill., assignor to Cardwell-Westinghouse Company, a corporation of Delaware

Application December 31, 1934, Serial No. 759,817

9 Claims. (Cl. 267—4)

This invention relates to spring units, and, more particularly, to a bolster supporting spring member.

One of the objects of the invention is the provision of a new and improved spring unit having novel means for resisting the compression of the unit.

Another object of the invention is the provision of a new and improved spring unit having novel means for preventing harmonic vibration of the unit in use.

A further object of the invention is the provision of a new and improved spring unit of the dimensions of a conventional helical railway bolster spring but with greatly increased capacity.

Another object of the invention is the provision of a spring unit adapted for supporting a railway bolster that is simple in construction, efficient in operation, that is adapted to be substituted for a conventional helical bolster spring and which is not likely to become broken or get out-of-repair.

Other and further objects and advantages of the invention will appear from the following description taken in connection with the accompanying drawing, in which:

Fig. 1 is a side elevation of a railway truck with parts broken away and parts omitted for the sake of clearness;

Fig. 2 is a vertical section of the bolster supporting unit;

Fig. 3 is a section on the broken line 3—3 of Fig. 2; and

Fig. 4 is a section similar to Fig. 3 but showing the unit compressed.

In spring suspension for railway freight cars, it is common practice to employ a spring assembly of helical springs for supporting each end of the bolster from the truck frame. The helical type of spring is eminently satisfactory so far as its function of resiliently supporting the weight of the car is concerned, but it has the disadvantage that it is subject to harmonic vibration. In other words, under certain conditions, as when the ends of the rails become slightly elevated or depressed or where the wheels have flat portions on their peripheries or treads, and the speed is such as to cause the movement of the wheels over these rail joints or the rotation of the flat portions on the peripheries of the wheels to synchronize with the periodic vibration of the spring assembly, the vibrations will build up to such an extent that the car if heavily loaded may damage the springs by causing them to go solid and in doing so to break or otherwise injure the frame. Instances are known where this harmonic vibration has built up to such an extent as to cause the car to become derailed. Furthermore, the building of freight cars with progressively increasing sizes and weights has necessitated the use of springs of greater and greater capacities. But the small space allotted to the springs by car builders creates a serious problem for the spring designer to provide the desired spring capacity in the required space.

The present invention is designed to overcome these difficulties by providing a spring unit that may be substituted for one or more of the helicals in a conventional bolster supporting spring assembly, that has the desired capacity and is provided with novel means for preventing harmonic action of the assembly.

Referring now to the drawing, the reference character 10 designates a portion of a railway truck 12 comprising a side frame 11 having a bolster opening therein through which the end of the bolster 13 extends. A spring plank 14 extends through the opening and a spring assembly designated generally by the reference character 15 is inserted beneath the bolster and rests on the spring plank for resiliently supporting the bolster. Since the specific construction of the side frame and bolster constitute no part of the present invention, it is not thought necessary to further illustrate or describe the same. The spring assembly 15 comprises upper and lower spring plates 16 and 17 between which are helical springs 18, one of which is shown in Fig. 1, and one or more spring units 19. The spring unit 19 is so designed as to increase the capacity of the spring assembly and prevent harmonic vibration thereof.

In the form of the device shown, a cylinder 21 is provided having a bottom wall or base 22 which is preferably circular and provided with upwardly extending fins or ribs 23 that may be, and preferably are, integral with both the base and side of the cylinder. The inner ends of the ribs 23 are integral with a circular plate 24 which has an axial opening 25 therethrough. The upper portion of the plate about the opening is beveled to constitute a valve seat for a ball valve 26. The plate 24 is concave and is provided with an upwardly extending peripheral portion 27 which is beveled on its inner edge, as at 28, to form a valve seat, as will presently appear.

A hollow piston 29 is fitted within the cylinder 21. This piston constitutes the supporting portion of the unit and telescopes within the cylinder 21. Suitable means are provided for limiting the outward movement of the piston relative to

the cylinder. In the form of construction shown, the piston is provided with a plurality of peripheral grooves 31 extending longitudinally of the cylinder wall and a set screw 32 secured in the upper end of the cylinder 21 and provided with a projection 33 engaging in the groove 31 is adapted to prevent withdrawal of the piston from the cylinder. The piston 29 is provided with an auxiliary piston 34 which extends downwardly axially of the base or supporting end wall 35 of the piston 29. This piston is adapted to telescope into an auxiliary cylinder or valve member 36, the lower end of which is provided with an extension 37 having a beveled surface 38 for seating on the bevelled surface 28 of the plate 24. The extension 37 overhangs or projects inwardly beyond the inner edge of the upwardly extending portion 27. The auxiliary cylinder 36 is provided adjacent its lower end with a flange 39 which constitutes a seat for a spring 41 which encircles the sleeve 36 and engages the top plate 35. This spring is adapted to return the parts to extended position after compression. The piston 29 and the auxiliary piston 34 are provided with suitable piston rings or packing 42 and 43, respectively.

When the parts are assembled, the cylinder 21 is partially filled with a liquid, preferably above the level of the diaphragm 46 when the unit is in extended position, and in the operation of the device when the unit is compressed, the liquid in the auxiliary cylinder or valve member 36 will be forced downwardly by the auxiliary piston 34 and this hydraulic pressure operating on the overhanging extension 37 will elevate the member 36 against the tension of the spring 41, permitting the escape of the liquid from the auxiliary cylinder or valve member 36 into the main cylinder 21.

The capacity of the units may be varied by varying the dimensions of the overhanging extensions 37. If the parts are so constructed that the part 37 overhangs the valve seat to a greater extent than as shown on the drawing, the capacity of the unit will be less than the unit shown and vice versa.

When it is desired to increase the capacity of the spring assembly, it may be done in one of two ways, either by substituting additional units for the helicals or by employing units in which the overhanging extension 37 is reduced.

Suitable means are provided for cushioning the initial compressive forces which may be received on the plate 35 while in service. Any suitable mechanism may be employed for this service. In the form of construction shown, a spring plate is used. As shown in Figs. 2 and 3, the piston 34, which is provided with a bottom wall 44, has its side wall extended downwardly beyond said wall and provided with an annular shoulder 45 against which a spring plate 46 is clamped, as by means of the annular clamping member 47.

In operation, a downward thrust movement of the auxiliary cylinder 34 will be initially cushioned by the resilience of the plate 46 which is permitted a slight movement before it comes in contact with the projection or seat 48 on the bottom wall 44 of the piston 34.

The parts are so arranged and proportioned that slightly before or simultaneously with the seating of the plate 46 on the projection 48 the valve member 36 will rise to permit the escape of the liquid into the outer cylinder. Upon rebound the valve member 36 will seat and the liquid will be returned by suction and gravity past the valve 26 into the inner cylinder or valve member 36. A bar 40 within the sleeve member 36 limits the upward movement of the valve and retains it in proper position.

In practice, one or more of the conventional helical springs are replaced by one or more of the units and in order to properly equalize the resistance to the downward movement of the bolster and prevent turning of the same, the units are symmetrically arranged. For instance, if only two of the units are employed for each bolster, one is located at the end of the bolster on the forward side, and the other at the opposite end of the bolster on the rear side.

It is thought from the foregoing taken in connection with the accompanying drawing that the construction and operation of my device will be apparent to those skilled in the art, and that changes in size, shape, proportion and details of construction may be made without departing from the spirit and scope of the appended claims.

I claim as my invention:—

1. In a spring suspension for railway cars, a main cylinder for containing a liquid, an auxiliary cylinder within said main cylinder and containing a liquid, a spring surrounding said auxiliary cylinder and adapted to assist in supporting a car, and means including said spring for controlling the transference of liquid from said auxiliary to said main cylinder upon compression of said unit.

2. In a spring unit for railway car spring suspension, a primary cylinder adapted to contain a liquid, said cylinder having a closed lower end provided with a plate member held in spaced relation to the bottom and side walls of the said plate having an axial opening and a valve seat on its peripheral edge, a hollow piston, an open-ended cylinder within said primary cylinder having an extension on one end engaging said seat and overhanging the same, a spring for resisting the movement of said piston and the unseating of said open-ended cylinder and an inner piston for said last-named cylinder movable with said first-named piston.

3. In a spring unit for railway car spring suspension, a primary cylinder adapted to contain a liquid, said cylinder having a closed lower end provided with a plate member held in spaced relation to the bottom and side walls of the said plate having an axial opening and a valve seat on its peripheral edge, a hollow piston, an open-ended cylinder within said primary cylinder having an extension on one end engaging said seat and overhanging the same, a spring for resisting the movement of said piston and the unseating of said open-ended cylinder, and a resilient metal plate carried by said hollow piston for cushioning the initial compressive forces delivered to said unit.

4. A spring unit for car spring suspension, comprising a pair of telescopic members adapted to contain a liquid, a pair of telescopic elements within said members adapted to contain a liquid, one of said members having a valve seat on which one of said elements is adapted to seat, and a spring for yieldingly resisting the compression of said unit and the unseating of said element.

5. A spring unit comprising a pair of telescopic members, a pair of elements defining a space within said members for containing a liquid, said space being at its maximum when said members are extended and at its minimum when they are compressed, means including one of said elements

for controlling the flow of liquid from said elements into said members when said unit is compressed, and a valved passage through which said liquid is returned when said unit is expanded.

6. A spring unit comprising compressible members adapted to contain a liquid, compressible means within said members adapted to contain a liquid and to be compressed for discharging liquid therefrom into said members when said unit is compressed, and means including a spring for controlling the flow of liquid from said compressible means to said members when said unit is compressed, said spring returning said members to extended position after compression.

7. In a spring suspension for railway cars, a spring unit comprising a reservoir, a cylinder movable relative to said reservoir and adapted to receive a liquid therefrom when the unit expands, a piston for said cylinder, a resilient supporting member for resisting the compression of said unit, means including said cylinder for placing said reservoir in communication with said cylinder for receiving liquid from the cylinder when said unit is compressed, and hydraulic mechanism comprising a valve controlled by said member for resisting the compression of said unit.

8. In a railway car, a truck frame, a truck bolster, a spring assembly for supporting said bolster from said frame, said assembly comprising helical springs and a spring unit operating in parallel, said unit comprising hydraulic mechanism and a resilient supporting member, said mechanism including a cylinder, a reservoir surrounding said cylinder and containing a fluid, a pressure valve and a check valve of restricted area for controlling the flow of said fluid between said reservoir and cylinder for dampening both the compression and expansion movement of said unit.

9. A spring unit for railway car spring suspension, comprising a resilient supporting member and hydraulic mechanism for controlling the compression of said unit, said mechanism comprising a cylinder for containing a liquid, a piston for said cylinder, said piston having an imperforate resilient disk on the end contacting said liquid for cushioning the sudden compression movement of said piston, and means for engaging the central portion of said disk for limiting its inward flexing movement.

DONALD F. SPROUL.

Oct. 30, 1951 J. C. SETTLES 2,573,165

DAMPING MEANS FOR RAILWAY TRUCKS

Filed Feb. 16, 1948 4 Sheets-Sheet 1

Fig. 1

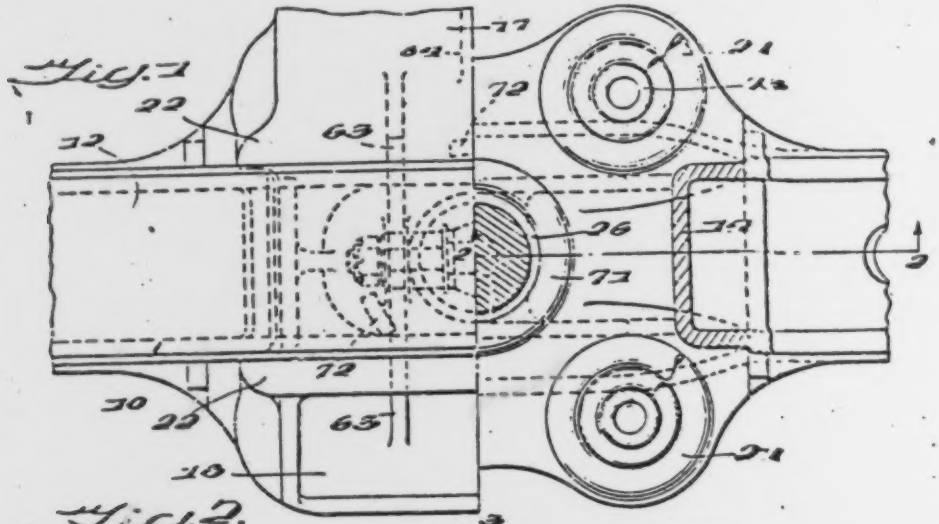
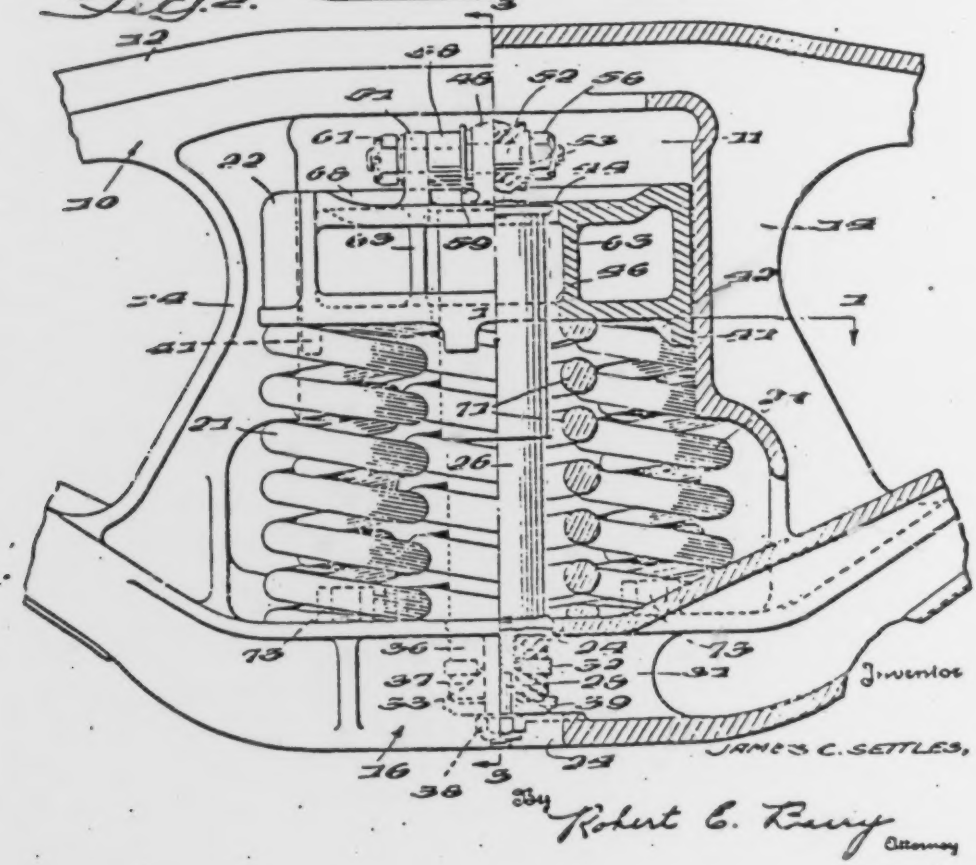


Fig. 2.



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By Robert C. Ramy
Attorney

PLAINTIFF'S EXHIBIT 69

Oct. 30, 1951 J. C. SETTLES 2,573,165

DAMPING MEANS FOR RAILWAY TRUCKS

Filed Feb. 16, 1948 4 Sheets-Sheet 2

Fig. 4.

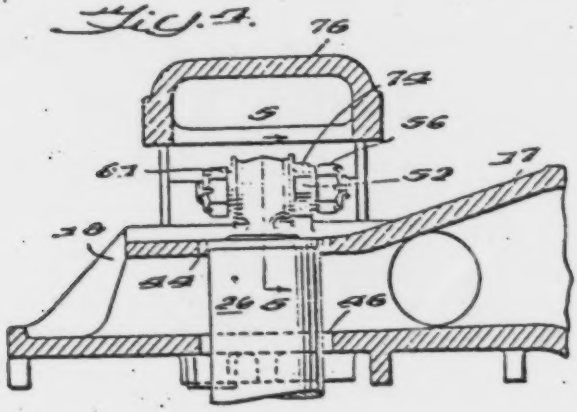


Fig. 5.

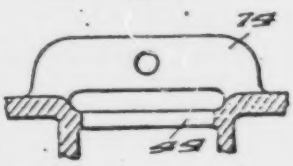
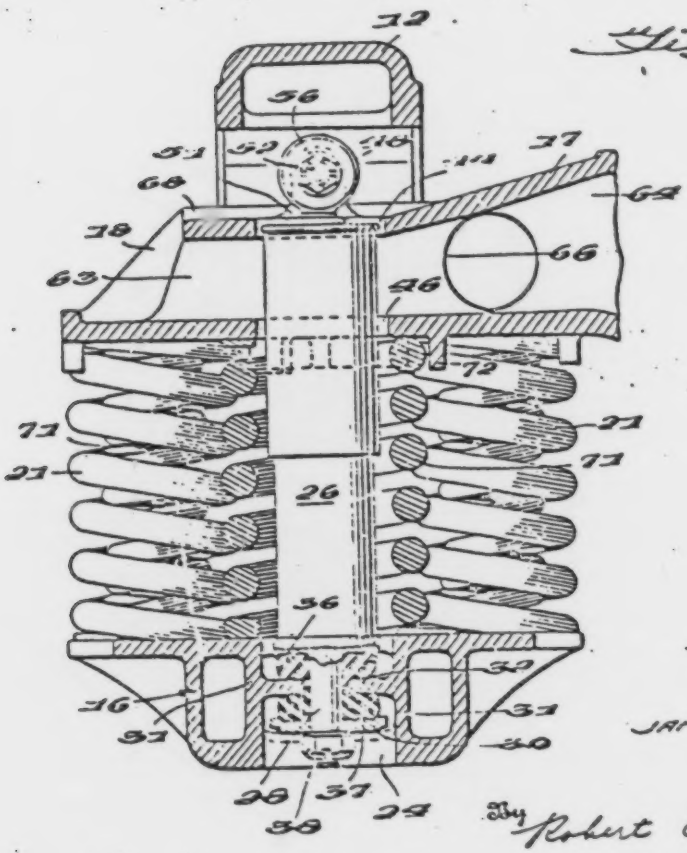


Fig. 3.



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DAMPING MEANS FOR RAILWAY TRUCKS

Filed Feb. 16, 1948 4 Sheets-Sheet 3

Fig. 6.

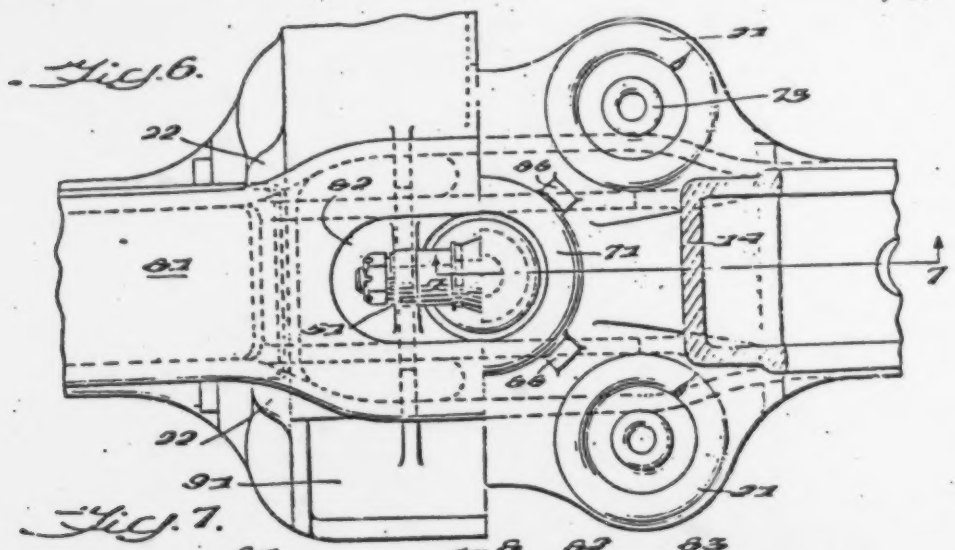
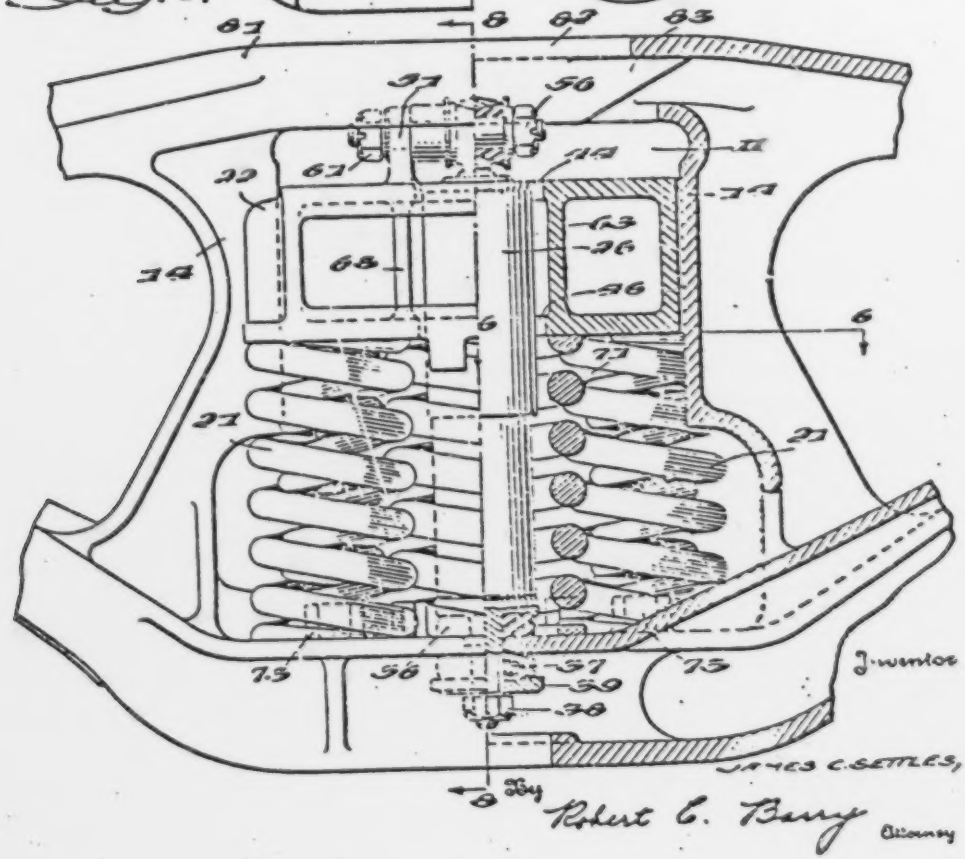


Fig. 7.



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Attorney

Oct. 30, 1951 J. C. SETTLES 2,573,165

DAMPING MEANS FOR RAILWAY TRUCKS

Filed Feb. 16, 1948 4 Sheets-Sheet 4

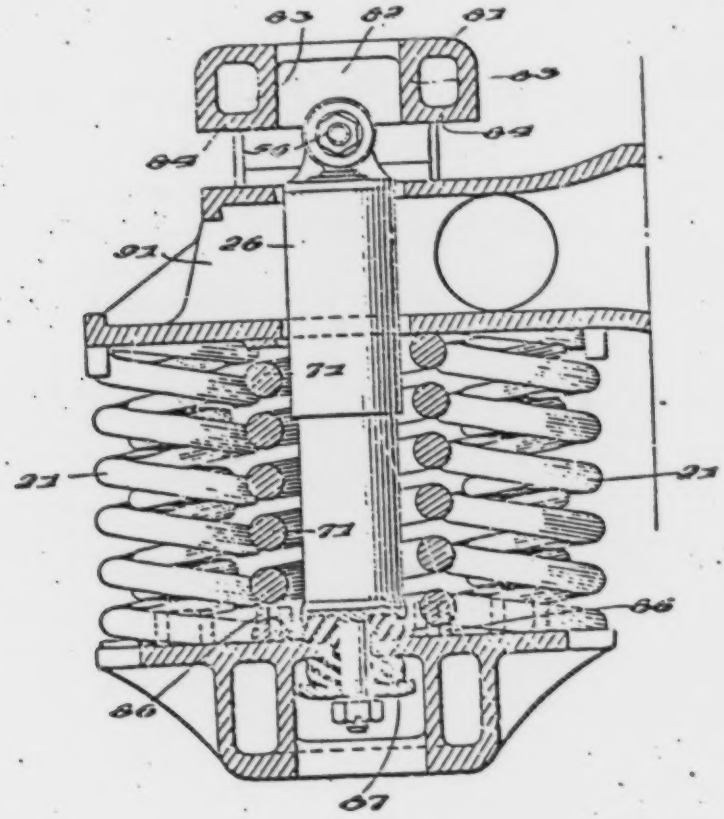

Fig. 6.

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Patented Oct. 30, 1951 2,573,165

UNITED STATES PATENT OFFICE

2,573,165

DAMPING MEANS FOR RAILWAY TRUCKS

James C. Settles, Columbus, Ohio, assignor to The Buckeye Steel Castings Company, Columbus, Ohio

Application February 16, 1948, Serial No. 8,701

9 Claims. (Cl. 105—197)

1

The present invention relates to railway car trucks and particularly pertains to means for damping movement of the bolster. The invention is more specifically directed to the position of a hydraulic shock absorber relative to each side frame and the bolster.

In a known damping mechanism, a hydraulic shock absorber has been mounted at the outboard side of the side frame and attached to the end of the bolster by means of a bracket. The spring seat has been constructed to accommodate the lower end of the shock absorber which is then positioned at the outboard side of the bolster supporting springs. Such a construction and position of the shock absorber creates difficulties in the construction of the bolster and side frame and does not provide an assembly which is economical to manufacture and assemble. This prior arrangement of the hydraulic shock absorber also encroached upon the clearance outline defined by the Association of American Railroads. The mounting of the shock absorber in an unprotected position at the outboard side of the side frame also places the damping element in a position to be subject to damage due to flying track ballast in normal operation. The damping assembly further provides a projecting assembly which is disadvantageous in case of accidents.

In such an outboard position of the shock absorber, the damping forces are applied to the side frame at a considerable distance outwardly of the center line of the supports of the frame on the journals. These forces produce moments which tend to rotate the side frame about its supports on the axle journals. This condition is more pronounced and undesirable in spring plankless type trucks wherein the opposite side frames are not joined at the spring seat level by a spring plank and are accordingly free to rotate under the action of the shock absorber forces.

It is an object of the present invention to remove such disadvantages by positioning the hydraulic shock absorber at the intersection of the longitudinal center line of the side frame with the longitudinal center line of the bolster.

A further object of the invention resides in providing side frame and bolster constructions which are adaptable for mounting the shock absorber on the side frame and attaching it to the

2

bolster and facilitating the removal of the shock absorber in dismantling the truck assembly and at the same time providing a railway truck having adequate strength for carrying the loads imposed on these portions of the truck.

Other objects and features of the invention will be more apparent to those skilled in the art as the present disclosure proceeds and upon consideration of the following detailed description and the accompanying drawings wherein several exemplary embodiments of the invention are disclosed.

In the drawings:

Fig. 1 is a plan view in the left hand portion showing a railway car truck exhibiting the invention while the right hand portion is a section taken on the line 1—1 of Fig. 2.

Fig. 2 in the left hand portion is a side elevational view of a part of the railway truck with the right hand portion depicting a section taken on the line 2—2 of Fig. 1.

Fig. 3 is a vertical section of the bolster and the side frame taken on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary vertical section of the bolster end and a portion of the side frame showing a modification.

Fig. 5 is a fragmentary sectional view taken on the line 5—5 of Fig. 4 with parts of the shock absorber omitted.

Fig. 6 in the left hand portion is a plan view of another modification while the right hand portion is a sectional view taken on the line 6—6 of Fig. 7.

Fig. 7 in the left hand portion is a side elevational view while the right hand portion is a section taken on the line 7—7 of Fig. 6.

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 7.

The present invention is directed to an arrangement of a shock absorber of the liquid or hydraulic type in a general vertical plane defined substantially by the intersection of the longitudinal center line of the side frame with the longitudinal center line of the bolster. This position of the shock absorber removes the tendency of any turning moments resulting from the forces produced by the shock absorber tending to rotate the side frame about its supports on the journals and also applies the damping forces to the center line of the bolster.

Referring to the drawings, there is shown at 10, a side frame of usual construction having a central bolster opening 11 and a top compression member 12. The side frame includes bolster guide columns 14 and a spring seat 16 forming a part of the tension member of the side frame. The spring seat may be of box construction, as shown particularly in Fig. 3.

A bolster 17 is provided with an end portion 18 which extends into the bolster opening 11 and is supported on a plurality of helical springs 21. These springs rest at their lower ends on the spring seat 16 and the load carried by the bolster is thereby supported by the springs 21. The end portion of the bolster may be provided with lugs 22 as shown in Figs. 1 and 2, which embrace the bolster guide columns 14 at each side of the bolster opening in the usual manner.

The spring seat portion of the tension member is provided with an opening 24 arranged midway between the bolster guide columns 14 and with the axis of this opening aligned with the center line of the side frame. This opening 24 extends through the box section of the spring seat member. The opening 24 is provided for receiving the lower end portion of a liquid or hydraulic type shock absorber of a well-known construction represented at 26 in the drawings. The lower end portion of the shock absorber 26 is provided with a stem 28. A pair of spaced walls 31 extend longitudinally of the spring seat member and define the inboard and outboard dimensions of the opening 24. These walls join the top and bottom webs of the box-shaped spring seat member for reinforcing this portion of the side frame and in the region of the opening 24. A horizontal web 32 having a central opening 33 extends between the spaced walls 31 to form part of means for the attachment of the stem 28 of the shock absorber to the tension member of the side frame. The vertical location of the web 32 with reference to the spring seat member may be varied to accommodate the particular shock absorber and the springs employed in the car truck. The lower end of the shock absorber is attached to the tension member by means of resilient bushings 36 and 37 which are arranged on opposite sides of the horizontal web 32 and by means of a nut 38 threaded onto the stem 28. A washer 39 may be interposed between the nut 38 and the resilient bushing 37.

The end portion 18 of the bolster 17 is desirably of box section and may be provided with side wall extensions 41 braced by ribs 42 to increase the column bearing area, as shown in Fig. 2. An opening 44 is provided in the top wall of the bolster aligned with an opening 45 in the bottom wall of the bolster. The axis of these two aligned openings is arranged in a vertical plane coinciding with the longitudinal center of the bolster 17. These openings 44 and 45 are provided for the upper end portion of the hydraulic shock absorber 26. The upper end of the hydraulic shock absorber carries a loop 48 and this loop is of sufficiently small overall dimensions to pass through the openings 44 and 45.

The upper end of the shock absorber 26 is attached to the bolster 17 by means of a bracket 51 rigidly attached to, or forming a part of, the bolster and arranged at one side of the aligned openings 44 and 45, as shown in Fig. 2. The loop 48 is attached to the bracket 51 by means of a bolt 52 which extends through the loop 48 and an aperture in the bracket 51. A resilient bushing 53 may be provided between the nut 56 and the loop 48. A spacer element 58 may be provided between the bracket 51 and the loop 48. Another resilient bushing 59 may be interposed between the loop 48 and the spacer element 58. Another nut 61 completes one type of means for attaching the shock absorber to the bolster.

The bracket 51 is positioned at one side of the openings 44 and 45 in the bolster to facilitate assembly of the parts and this bracket is then positioned so that the attachment assembly at the top of the bolster including the bracket 51 may enter the inverted channel in the compression member 12 of the side frame when the bolster is raised in the bolster opening 11 to apply or remove the springs 21 or for other purposes such as in shimming the assembly. The bolster in the region of the openings 44 and 45 may be reinforced by a plurality of longitudinal ribs 63 which connect the top and bottom walls of the bolster. One of these ribs 63 is provided on each side of the openings 44 and 45. The ribs 63 extend inwardly beyond the openings 44 and 45 and terminate at 64 adjacent a point where the central bolster rib 14 starts.

The bracket 51 is arranged to extend upwardly from the top wall of the bolster and is positioned at the side of the opening 44, as hereinabove described. If necessary, the top wall of the bolster may be depressed, as indicated at 68 to provide additional clearance for applying and removing the nuts 56 and 61. This depressed portion of the top wall of the bolster extends through the central portion as will be evident upon consideration of Fig. 2. This arrangement does not, therefore, reduce the column bearing areas of the bolster.

If desirable, and if required for carrying the load imposed on the bolster, a helical spring 71 may be positioned around the shock absorber 26. The spring 71 is maintained in a spaced relationship around the shock absorber by means of a plurality of lugs 72 which depend from the bolster and prevent lateral displacement of the spring 71. This arrangement of the lugs 72 facilitates assembly of the shock absorber and the spring 71 on the truck. The other load supporting springs 21 may be maintained in proper position by central circular spuds 73 projecting upwardly from the spring seat, as shown in Fig. 2. If desired, the usual spring plates may be used at the top and the bottom of the load supporting springs in which case the spring positioning means would be formed on the spring plates rather than carried by the bolster and the side frame castings.

In assembling the shock absorber and the bolster in proper position on each side frame, the bolster is first raised to the top of the bolster opening 11. Thereafter the shock absorber 26 is compressed to its minimum length. The shock absorber is then arranged within the spring 71 and this spring and the shock absorber is tilted or arranged at an angle and moved in this position into the bolster opening. Thereafter, the top portion of the shock absorber or the loop 48 is passed upwardly through the openings 45 and 44 in the end portion 18 of the bolster. The top portion of the shock absorber is raised until the loop 48 extends into the inverted channel of the compression member 12. With the parts in this position, the lower end of the shock absorber is then swung into the bolster opening. During this

operation the stem 28 arranged on the lower end of the shock absorber is lowered to pass through the opening in the horizontal web 32. The resilient bushing 36 is preferably applied on the stem 28 before the introduction of this part into the opening in the spring seat. The resilient bushing 37 may then be applied and the nut 38 is then threaded onto the stem 28. The resilient bushing 37 and the washer 39 and the nut 38 can be arranged on the stem 28 through the opening 34. The bolt 52 and the associated parts may then be applied to the loop 48 to connect the upper end of the shock absorber to the bracket 51.

The coil springs 21 at the inward positions or those toward the inboard side of the side frame may be applied before the shock absorber is arranged in position. The coil springs 21 at the outboard side of the side frame are preferably arranged in position after the shock absorber is positioned within the bolster opening. The upper end of one spring 71 will swing into position between the positioning lugs 72 as the shock absorber is applied in the manner as hereinabove described.

It will be observed that the hydraulic shock absorber 26 is arranged at the intersection of the center line of the bolster 17 with the center line of the side frame. Accordingly, the damping forces of the shock absorber do not set up any reaction moments tending to shift or twist the side frame from its proper position with respect to the journals. The shock absorber is, furthermore, located within the nest of springs so as to be protected from flying ballast and the assembly does not create any problems with reference to clearance in that the damping means is located within the side frame and does not project beyond the normal position of the side frame parts.

In the modification shown in Figs. 4 and 5, a bracket 74 is positioned on the inboard side of the openings 44 and 46 in the bolster. The attachment of the shock absorber to the bracket 74 is made in the same manner as that described with reference to the embodiments shown in Figs. 1 to 3, except that the bolt 52 extends longitudinally of the bolster instead of transversely thereto. Under some conditions of clearance, this construction and arrangement of the bracket 74 may be preferred for facilitating the application of the nuts 56 and 61 to the bolt 52. In this form of the invention, the compression member 76 is wider than that of the previous construction to permit the bracket 74 and the attaching means to enter the inverted channel in the compression member 75 when the bolster is raised to the top of the bolster opening.

In the embodiment illustrated in Figs. 6, 7 and 8, the compression member 81 of the side frame is widened over the bolster opening 11 and is provided with an aperture 82 through which the shock absorber 26 may be applied and removed from the side frame. The compression member is provided with spaced longitudinal walls 83 at each side of the opening 82 to reinforce the top member of the side frame in the vicinity of the opening 82. Horizontal webs 84 are provided between the lower ends of the walls 83 and the side walls of the compression member to further reinforce this portion of the side frame. In this modification, the coil spring 71 is maintained in proper spaced relationship around the shock absorber 26 by means of a plurality of lugs 86 which extend upwardly from the spring seat member.

As shown in Figs. 7 and 8, the horizontal web provided on the spring seat member is raised to the level of the top wall of the spring seat member and is indicated at 87 in Fig. 8. A deeper bolster end 91 may be used in this structure than that of the previous embodiments and it may not be necessary to extend the side walls below the box section to obtain adequate column bearing area.

While the invention has been described with reference to specific structural details, it will be understood that changes may be made in the assembly and in the elements thereof such as the type of hydraulic shock absorber and the manner in which the absorber is attached to the side frame and the bolster. Such changes and others may be made without departing from the spirit and scope of the invention, as set forth in the appended claims.

What I claim and desire to secure by Letters Patent is:

1. In a railway car truck, a side frame including a compression member having an intermediate portion of inverted channel-shape, said side frame having a centrally arranged bolster opening therein, a spring seat box-shaped in cross section forming a part of the side frame and having top and bottom walls, said bottom wall having an opening therein, ribs arranged longitudinally of the side frame within the spring seat joining the top and bottom walls defining the sides of the opening in the bottom wall, a bolster having a box-shaped end portion extending into the bolster opening, springs supporting the bolster on said spring seat, an elongated hydraulic shock absorber, a stem carried by the lower end of said shock absorber, means securing the stem to the spring seat including a nut accessible through the opening in the bottom wall of the spring seat, said bolster having an opening in the bottom wall thereof and an aligned opening in its top wall both of diameters large enough to receive an upper end portion of the shock absorber, a loop member carried by the upper end of the shock absorber, a bracket above and rigid with the top wall of the bolster and arranged at one side of the openings in the bolster, means extending through the bracket and the loop member connecting the upper end of the shock absorber to said bracket, ribs joining the top and bottom walls of the bolster extending longitudinally therein and arranged at opposite sides of the openings in the top and bottom walls, a centrally disposed rib joining the top and bottom walls of the bolster positioned inwardly of the inner ends of the first ribs, and said bracket and loop member being of such lateral dimensions as to be accommodated within the channel of the compression member when the bolster is raised in the bolster opening.

2. In a railway car truck, a side frame, said side frame having a bolster opening therein, a spring seat box-shaped in cross-section forming a part of the side frame and having top and bottom walls, said bottom wall having an opening therein, ribs arranged longitudinally of the side frame within the spring seat joining the top and bottom walls at an inboard and outboard side of the opening in the bottom wall, a horizontal web joining said ribs below the top wall of the spring seat, said web having an opening therein, a bolster having a box-shaped end portion extending into the bolster opening, helical springs supporting the bolster on said spring seat, an elongated hydraulic shock absorber, a stem carried by the lower end of the shock absorber extending through the opening in said web, means accessi-

ble through the opening in the bottom wall of the spring seat for securing the stem to said web, said bolster having an opening in the bottom wall thereof and an aligned opening in the top wall both of a diameter large enough to receive the upper end portion of the shock absorber, a loop member carried by the upper end of the shock absorber, a bracket rigid with the top wall of the bolster, means extending through the bracket and the loop member connecting the upper end of the shock absorber to said bracket, means within and reinforcing the bolster in the vicinity of the openings in the top and bottom walls, and the top wall of the bolster having a depressed portion in the region of the bracket and upper end of the shock absorber.

3. In a railway car truck, a side frame including a compression member, said side frame having a bolster opening, a spring seat box-shaped in cross section including top and bottom walls, said bottom wall having an opening therein, ribs arranged longitudinally of the spring seat joining the top and bottom walls and providing inboard and ouboard walls for the opening in the bottom wall of the spring seat, a bolster having a box-shaped end portion including top and bottom walls extending into the bolster opening, springs supporting the bolster on said spring seat, an elongated hydraulic shock absorber, means for securing a lower end of the shock absorber to the spring seat including a nut accessible through the opening in the bottom wall of the spring seat, said bolster having an opening in the bottom wall thereof and an aligned opening in the top wall both large enough to receive the upper end of the shock absorber, a loop member carried by the upper end of the shock absorber, a bracket rigid with the top wall of the bolster, means connecting the loop member to the bracket to secure the upper end of the shock absorber to the bolster, means reinforcing the bolster in the vicinity of the bracket, and said compression member having an opening vertically therethrough of larger area than the cross section of the shock absorber.

4. In a bolster for a railway car truck, a top wall, a bottom wall, side walls connecting the top and bottom walls, said top wall having an opening therethrough, said bottom wall having an opening therethrough vertically aligned with and of substantially the same size as the opening in the top wall, vertically disposed ribs extending longitudinally within the bolster joining the top and bottom walls at opposite sides of said openings, and a bracket carried by the top wall at one side of the opening therein for attachment to a bolster damping means extending through said openings.

5. In a bolster for a railway car truck, a top wall, a bottom wall, side walls connecting the top and bottom walls, said top wall having an opening therethrough, said bottom wall having an opening therethrough vertically aligned with and of substantially the same size as the opening in the top wall, vertically disposed ribs extending longitudinally within the bolster joining the top and bottom walls at opposite sides of said openings, a bracket carried by the top wall at one side of the opening therein for attachment to a bolster damping device extending through said openings, and said bracket being vertically aligned with one of said ribs.

6. In a bolster for a railway car truck, a top wall, a bottom wall, side walls connecting the top and bottom walls, said top wall having an opening therethrough, said bottom wall having an opening therethrough vertically aligned with and of substantially the same size as the opening in the top wall, vertically disposed ribs extending longitudinally within the bolster joining the top and bottom walls at opposite sides of said openings, a bracket carried by the top wall at one side of the opening therein for attachment to bolster damping means extending through said openings, and said top wall having a depressed area in the upper surface in a region surrounding the bracket and the opening in the top wall.

7. In a railway car truck, a side frame, said side frame having a bolster opening therein, a spring seat box-shaped in cross section forming a part of the side frame and having top and bottom walls, said bottom wall having an opening therein, ribs arranged longitudinally of the side frame within the spring seat joining the top and bottom walls at the inboard and outboard sides of the opening in the bottom wall, a bolster having a box-shaped end portion extending into the bolster opening, springs supporting the bolster on said spring seat, an elongated hydraulic shock absorber, means securing a lower end of the shock absorber to the spring seat including a nut accessible through the opening in the bottom wall of the spring seat, said bolster having an opening in the bottom wall thereof of a diameter large enough to receive an upper end portion of the shock absorber, a bracket rigid with the top wall of the bolster, means connecting the upper end of the shock absorber to said bracket to secure the upper end of the shock absorber to the bolster, and means within and reinforcing the bolster in the vicinity of said bracket.

8. A side frame for a railway car truck comprising, a compression member, a tension member including a spring seat of box-shaped section throughout the length of the spring seat and having top and bottom walls, said bottom wall of the spring seat having an opening therein, vertically disposed ribs within the box-shaped spring seat extending longitudinally thereof throughout a major portion of the length of the spring seat joining the top and bottom walls and providing two spaced box-shaped sections throughout a central portion of the spring seat, said ribs defining the inboard and outboard boundaries of the opening in the bottom wall, and said top wall of the spring seat having an opening therein with the axis thereof aligned with the axis of the opening in the bottom wall of the spring seat.

9. A side frame for a railway car truck comprising, a compression member including depending side walls throughout an intermediate portion thereof, a tension member including a spring seat of box-shaped section throughout the length of the spring seat and having top and bottom walls, guide columns connecting the tension member and the compression member defining a bolster opening, said bottom wall having an opening therein, vertically disposed ribs within the box-shaped spring seat extending longitudinally thereof throughout a major portion of the length of the spring seat joining the top and bottom walls thereof and providing two spaced box-shaped sections throughout a central portion of the spring seat, said ribs defining inboard and outboard boundaries of the opening in the bottom wall, said top wall of the spring seat having an opening therein with the axis thereof aligned with the axis of the opening in the bottom wall of the spring seat, said compression member having an opening vertically disposed therethrough in a portion over the bolster open-

ing, and a vertically disposed wall depending from the compression member at each side of the opening therein and extending lengthwise of the frame between the guide columns.

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SELF-ADJUSTING STABILIZER FOR SPRING SUSPENSION

Filed Sept. 17, 1957 2 Sheets-Sheet 1

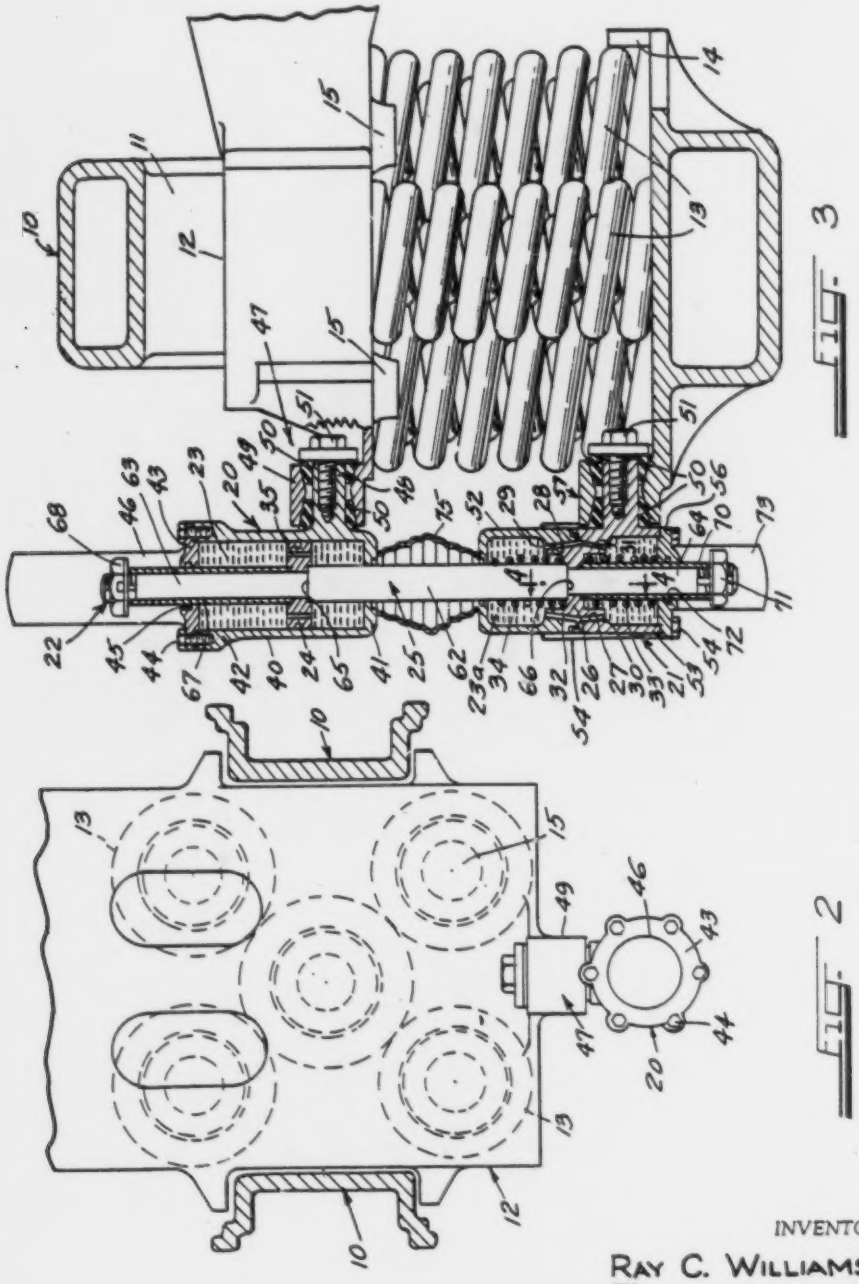

FIG. 3

FIG. 2

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Oct. 24, 1961 R. C. WILLIAMS 3,005,629

SELF-ADJUSTING STABILIZER FOR SPRING SUSPENSION

Filed Sept. 17, 1957 2 Sheets-Sheet 2

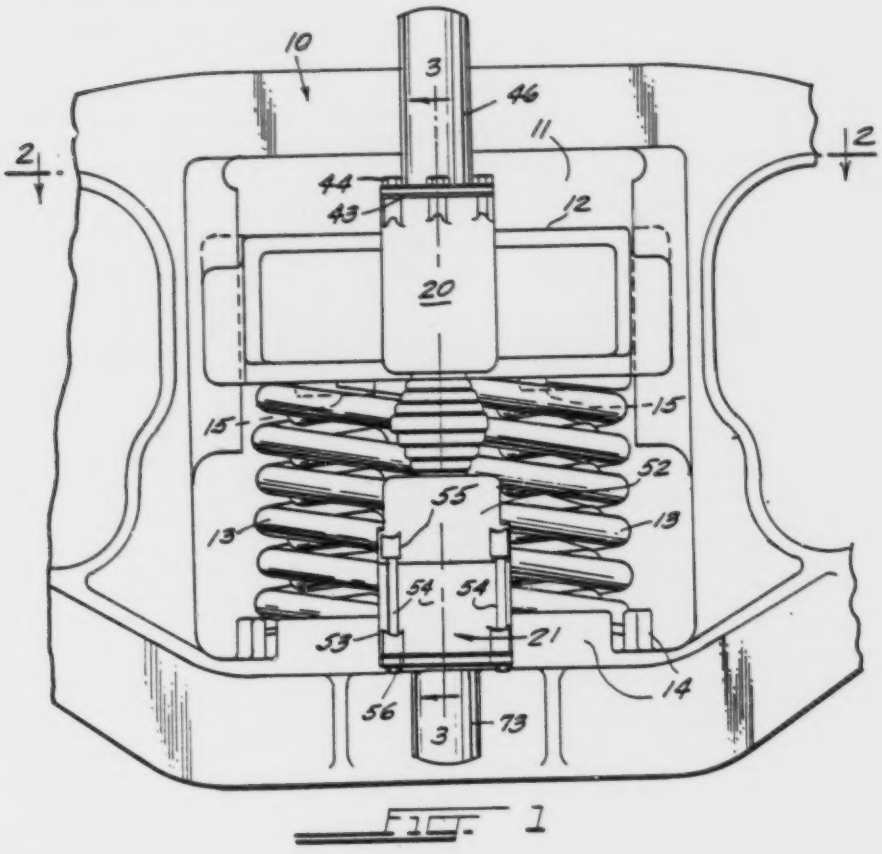

FIG. 1

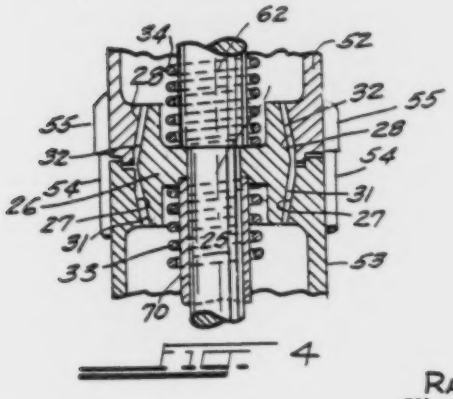

FIG. 4

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SELF-ADJUSTING STABILIZER FOR SPRING SUSPENSION

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Filed Sept. 17, 1957, Ser. No. 684,603
2 Claims. (Cl. 267—8)

The present invention relates to an improved self-adjusting stabilizing mechanism for a spring suspension. It has been designed for use as a means for stabilizing the undulations of the spring suspension structure of a railway car truck whereby the indulations of a set of load supporting springs are effectively damped. It is to be distinctly understood however that the invention is capable of other uses and the present stabilizing mechanism will be found useful in connection with motor vehicle or trailer suspension system, shock absorber means for aircraft landing gear or, in fact in connection with the damping of spring oscillations of objectional amplitudes, between two relatively movable bodies which are subjected to forces tending to move them relative to each other. Irrespective however of the particular use to which the present invention may be put, the essential features thereof are at all times preserved.

Spring suspension devices which are provided with friction type snubbing means employing friction shoes and cooperating wear plates for damping the oscillations between two relatively movable bodies, and especially variable load carrying bodies such as the bolster of a railway freight car for example which must be resiliently supported at each end from the car truck frame, are subject to variations in their operating characteristics, depending upon the initial load applied to the bolster at the time of any given run. The helical type of spring which is widely employed for supporting the weight of the railway freight car is quite satisfactory for this purpose but it is subject to harmonic vibrations in more or less direct proportion to the initial load, such vibrations being occasioned by various factors as for example when the ends of the rails are slightly elevated or depressed and the speed is such as to cause the wheel treads to move over the rail joints at a rate commensurate with the natural period of vibration of the spring assembly. In such an instance the vibrations will build up inordinately, particularly if the car is heavily loaded, sometimes to an extent which is beyond the ability of the snubbing devices associated with the spring suspension to assimilate them so that the springs will go solid and break or otherwise damage the frame. In other words, conventional snubbing devices associated with such spring assemblies are effective only throughout a predetermined range of vibrational amplitudes and, when the car is initially heavily loaded the springs are subjected to an initial displacement or deformation which remains permanent as long as the load is present. This initial displacement brings the friction shoes and their associated wear plates well into their effective working range at the outset so that when subsequent harmonic vibrations become effective as previously described, the peaks of such vibrations, i.e. the relatively large displacement amplitudes, will tend to either move the shoes and wear plates out of register or to cause them to jam so that the friction snubbing devices do not have the ability to dampen such vibrations and the springs will reach the limit of their free elasticity and go solid.

The present invention is designed to overcome the above noted limitations that are attendant upon the use of conventional friction type stabilizing devices and, toward this end, it contemplates the provision of a novel

form of hydraulic snubbing or vibration dampening means which may be operatively associated with a wide variety of spring suspension assemblies and which has the necessary capacity and will operate under all conditions of load to prevent harmonic vibrations of the assembly. According, it is among the principal objects of the present invention to provide a vibration dampening means which will, at the outset and regardless of the applied load, assume a neutral condition with the snubbing element of the dampening means being positioned substantially at the exact center of its effective snubbing stroke so that whenever vibrational effects are encountered, in either direction of displacement, the snubbing element will be immediately effective to apply its full snubbing action without moving out of its snubbing range.

In carrying out the above mentioned object, the invention contemplates the provision of a snubbing means which is essentially hydraulic in its operation, depending as it does upon the resistance offered by a solid column of a liquid to the snubbing member proper. Briefly, the invention provides a first hydraulic piston and cylinder assembly wherein the piston is interposed between two solid columns of liquid and through which piston the liquid is capable of being bled uniformly from one side of the piston to the other so that only gradual piston displacements are possible. The cylinder is bodily movable with the bolster to which it is rigidly attached. A second hydraulic piston and cylinder assembly wherein the piston is likewise interposed between two solid columns of liquid is also provided and the cylinder of this latter assembly is fixedly secured to and moves bodily with the truck frame. The second piston constitutes the snubbing element per se and this piston has associated therewith automatically operable valve means whereby the bleeding action across the piston from one column of liquid to the other is regulated in proportion to the extent of its displacement from a medial or mean position within the cylinder in which it operates.

While the first piston may exert some snubbing action limiting sudden relative displacements between the bolster and truck frame, its primary function is of an equalizing nature wherein the application of a load to the bolster or the removal of a load from the bolster tending to lower or elevate the bolster on its support, i.e. the truck frame, will, by a bleeding of the liquid from one side of the piston to the other, cause the piston to seek an equalized position within its respective cylinder.

The two pistons are rigidly connected together so that they move in unison and means are provided for yieldingly biasing the piston of the second piston and cylinder assembly so that it will assume its mean or medial position in the cylinder. By such an arrangement, it follows that since the two columns of liquid on opposite sides of each piston are capable of being bled through or around the piston, the biasing means will under all static conditions of the bolster and car truck be effective to urge the two rigidly connected pistons to positions of equilibrium in the hydraulic system, regardless of the imposed load on the bolster. In other words, a new load on the bolster will merely effect a new position of equilibrium for the two pistons as a unit, and in each position of equilibrium, the second or snubbing piston per se will assume its medial or mean position.

With the second or snubbing piston in this medial or mean position within its respective cylinder, it is at all times, regardless of the load or lack of load, maintained in readiness for immediate snubbing operation within the working range of which it is capable whenever sudden vibrational effects are encountered which it is desired shall be nullified or otherwise rendered harmless. Because of the automatic valve action previously mentioned, and the nature of which will be set forth fully herein-

after, the extent of the snubbing action presented by the snubbing piston will be substantially directly proportionate to the demand for such snubbing action as evidenced by the amplitude of displacement between the bolster and car truck from any given relative position of equilibrium.

The provision of a stabilizing mechanism of the character briefly outlined above being among the principal objects of the invention, it is a further object to provide a device of this sort which is effectively sealed against the entrance of dirt or other foreign material into the operative working parts thereof, either hydraulic or mechanical, and which will remain thus effectively sealed throughout the entire life of the mechanism.

A still further object of the invention, in a mechanism of this character, is to provide a stabilizing mechanism which may be readily applied to existing installations and which, for this purpose, is capable of immediate application to the two relatively moving bodies without requiring preliminary adjustment or fitting of parts and which furthermore, when so applied, will assume a condition for immediate use with the snubbing mechanism associated with the assembly assuming its neutral condition automatically as previously described.

The provision of a stabilizing apparatus which is relatively simple in its construction and which therefore may be manufactured at a low cost; one which is rugged and durable and which therefore is possessed of a relatively long life; one which is comprised of a minimum number of moving parts and which therefore is unlikely to get out of order; one which when assembled and installed in a desired environment is readily accessible for purposes of inspection, disassembly for replacement of parts or repair if necessary, and one which otherwise is well adapted to perform the services required of it, are further desirable features which have been borne in mind in the production and development of the present invention.

Other objects and advantages of the invention, not at this time enumerated, will become readily apparent as the following description ensues.

In the accompanying two sheets of drawings forming a part of this specification a preferred embodiment of the invention has been shown.

In these drawings:

FIG. 1 is a fragmentary side elevation view of an improved stabilizing device constructed in accordance with the principles of the present invention, showing the same operatively installed by way of example between a railway car truck frame and an associated bolster the movements of which it is desired to dampen.

FIG. 2 is a sectional view taken substantially along the line 2—2 of FIG. 1.

FIG. 3 is a sectional view taken substantially along the line 3—3 of FIG. 1 with the load springs of the car truck and the truck bolster being shown in elevation, and

FIG. 4 is an enlarged detail sectional view taken substantially on line 4—4 of FIG. 3.

Referring now to the drawings in detail, the side frame of a railway car truck is designated in its entirety at 10 and is provided with the usual bolster window 11 therein for reception of one end portion of a bolster 12. The bolster 12 is yieldingly supported by a group or nest of relatively heavy coil springs 13 which are maintained seated at their lower ends on the frame 10 by means of upstanding lugs or flanges 14 and at their upper ends by means of suitable centering lugs 15. The side frame 10 is provided at its opposite ends with the usual arrangement of supporting wheels (not shown) which cooperate with a similar arrangement of wheels and associated parts at the opposite side of the car truck and by means of which the truck may be supported on rails from the traction surface or ground. The arrangement of parts thus far described is more or less conventional in its design and it will be understood that any load which may be applied to the railroad car is in turn applied to the bolster 12 and from thence distributed through the load springs to the side frame 10. The load springs 13 are, of course, compressed in direct proportion to the applied load and, during operation of the car, these springs are subject to the usual vibrational effects as the car wheels pass over the rail joints or other irregularities in the roadbed surface and which vibrational effects it is desired to dampen according to the present invention.

The details of the present stabilizing system are best illustrated in FIG. 3 wherein there is shown an upper hydraulic equalizing cylinder assembly 20 operatively and fixedly secured to the bolster 12 for movement bodily therewith, a lower hydraulic snubbing cylinder assembly 21 operatively and fixedly secured to the side frame 10 for movement bodily therewith, and an interconnecting thrust rod or plunger assembly 22. Briefly, and as will be described in greater detail presently, the upper cylinder assembly 20 serves to confine a column or body 23 of an incompressible liquid so that the liquid is constrained to move bodily with the cylinder assembly and transmit its vertical movements to an hydraulic piston 24 mounted on a thrust rod proper 25. The thrust rod 25 carries a combined snubbing piston and valve member 26 which is disposed and operates within the lower snubbing cylinder containing a body of the liquid designated 23a. The said value member 26 cooperates with a pair of adjacent frusto-conical valve surfaces 27 and 28 when the thrust rod 25 is displaced in a downward or an upward direction respectively. The upper frusto-conical surface 28, in effect, defines a valve port 29 and the lower frusto-conical surface 27 defines, in effect, a valve port 30, the said piston or valve member 26 operating between the two ports and having frusto-conical surfaces 31 and 32 (FIG. 4) opposing the two surfaces 27 and 28.

The piston and valve member 26, which will hereinafter be referred to as the valve piston, is normally and yieldingly maintained in a "neutral" position of equilibrium out of contact with either surface 27 or 28 midway between the two ports 29 and 30 by means of a pair of biasing springs 33 and 34 which center the piston, so to speak, between the two frusto-conical surfaces 27 and 28 but which yield to permit cooperating valve action with either surface when undesired displacements in either direction are encountered. Movement of the valve piston 26, under the influence of its biasing springs 33 and 34 to its neutral position of equilibrium is made possible by virtue of one or more bleeding apertures 35 provided in the equalizing piston 24 whereby the liquid 23 may be gradually bled from one side of the piston to the other and whereby initial compression of the coil springs 13 or expansion thereof under the influence of loading or unloading respectively of the railway car will cause the biasing springs 33 and 34 associated with the valve piston 26 to relieve themselves gradually of any compressional forces which may be applied thereto so that these springs will ultimately bring the valve piston 26 to its neutral position regardless of the initial load involved. Such is the general nature and operation of the present stabilizing mechanism of the present invention and it remains merely to describe in more detail some of the operating instrumentalities associated therewith so that a full understanding of the invention may be had.

Referring now to FIG. 3, the upper hydraulic cylinder assembly 20 comprises an upright cup-shaped cylinder block 40 having a base portion 41 through which the thrust rod assembly 22 extends and having an upper thickened rim portion 42 which is closed by means of a closure plate 43 held in position on the rim by studs 44. The thrust rod assembly 22 likewise projects through the closure plate 43 and is sealed for sliding movement therein by a conventional sealing gland 45. A dust cap 46 serves to exclude dirt or other foreign material from the gland 45. The cylinder is attached to the bolster 12 through a flexible connection 47 which permits limited angular movement between the two parts to compensate

for lengthwise movement of the bolster while at the same time constraining the cylinder to follow the vertical movements of the bolster. This connection is in the form of a stud-like projection 48 which may be integrally formed on the cylinder block 40 and which is centered within a a tubular eyelet or boss 49 integrally formed on the bolster by means of a pair of rubber or other resilient mounting sleeves 50. The various parts are held in position by stud and washer assemblies 51.

The lower snubbing cylinder assembly 21 comprises a composite inverted cup-shaped block assembly comprising upper and lower block sections 52 and 53 respectively arranged in axial alignment and maintained in juxtaposition by means of elongated clamping studs 54 which have their ends threadedly received in lugs 55 (FIG. 1) formed on the section 52 and which also pass through and serve to maintain a closure plate 56 similar to the plate 43 in position on the lower open rim of the composite block assembly. The block section 53 is connected to the side frame 10 by a flexible connection 57 which may be identical with the connection 47 previously described and which therefore needs no further description herein. The adjacent rim portions of the two block sections 52 and 53 are formed with thickened portions which, when the sections are assembled upon each other afford the previously described valve surfaces 27 and 28. These two surfaces are of frusto-conical configuration and are designed for selective hydraulic action with the similar but complementary surfaces 31 and 32 respectively (see also FIG. 4) formed on the piston or shoe 26.

The thrust rod or plunger assembly 22 includes the previously mentioned thrust rod proper 25 which is formed with a medial portion 62 of enlarged diameter and with upper and lower end portions 63 and 64 respectively of reduced diameter, affording shoulders 65 and 66 at the ends of the enlarged medial portion 62. The upper hydraulic equilizing piston 24 which operates in the cylinder block 40 is of cylindrical configuration and is maintained fixed on the thrust rod 25 by means of a sleeve 67 which serves to clamp the piston 24 against the the shoulder 65. A clamping nut and washer assembly 68 on the upper end of the rod 25 serves to effect the clamping action. The valve piston 26 is similarly maintained on the rod 25 within the cylinder assembly 21 by means of a sleeve 70 and a clamping nut and washer assembly 71 on the lower end of the rod 25, the sleeve 70 serving to force the valve piston 26 against the shoulder 66.

The reduced portion 64 of the thrust rod 25, as well as the surrounding sleeve 70 projects downwardly and outwardly through the closure plate 56 through which they are slidable and in which they are sealed by a gland 72 similar to the gland 45. A dust cap 73 shields the gland 72 against the entrance of dirt and the like. In the medial regions of the stabilizer assembly a corrugated flexible sleeve 75 surrounds the enlarged medial portion 62 of the thrust rod 25 and bears at its end against the opposed outer end surfaces of the upper and lower cylinder assemblies 20 and 21 to thus shield this portion of the rod against accumulation of dirt which, otherwise, would be subject to entrance into the cylinder assemblies at the regions of entrance of the rod 25.

The biasing spring 34 surrounds the enlarged portion 62 of the rod 25 and bears at its upper end against the upper end wall of the cylinder block section 52 and at its lower end against the valve piston 26. The biasing spring 33 surrounds the reduced portion 64 of the rod 25 and bears at its lower end against the closure plate 56 and at its upper end against the valve piston 26. The compression of the two springs 33 and 34 is matched so that the valve piston 26 "floats" so to speak within the medial region of the cylinder assembly 21 and so that the surfaces 31 and 32 (FIG. 4) remain in close proximity to but out of actual contact with their cooperating valve surfaces 27 and 28 on the inner faces of the cylinder block sections 53 and 52 respectively. As previously described, the biasing action of the two biasing springs 33 and 34 is controlling insofar as the positioning of the valve piston 26 is concerned inasmuch as any pressure which may be built up within the cylinder assembly 20 in the body of liquid 23 therein on either side of the piston 24 due to loading or unloading of the railway car and consequent displacement of the bolster 12 with respect to the car truck frame 10 will become equalized on opposite sides of the piston 24 through gradual passage of the liquid through the openings 35. Regardless of the applied load therefore, the biasing springs 33 and 34 will ultimately bring the valve piston 26 to its inoperative or neutral position out of contact with the bearing surfaces 27 and 28 although the distance between the upper and lower cylinder assemblies 20 and 21 will become decreased or increased as the load is increased or decreased respectively.

While the railway car is traveling over a roadbed, abnormal or sudden shocks which are applied to the car truck or frame 10 due to unevenness of the rails on the roadbed for example or for any reason whatsoever while the car is in motion will be transmitted to the snubbing cylinder assembly 21, thus displacing the cylinder proper vertically in one direction or the other. If, for example, a rise caused by an undulation in one of the track rails is encountered, the car truck frame, together with the cylinder 21 will be displaced upwardly, thus compressing the load springs and also placing the liquid 23*a* in the lower portions of the lower cylinder 21 under pressure. The pressure thus developed in the liquid in the cylinder 21 below the valve piston 26 will tend to cause the liquid to be bled to the opposite or upper side of the cylinder 21 while at the same time the resistance offered by the piston to the incompressible column of liquid during the bleeding action constituting a major portion of the snubbing or reaction force to the displacement between the bolster and car truck frame. Since, except for the provision of the centering springs 33 and 34, the piston and piston rod assembly 24, 25, 26 is a free floating member, the reaction offered by the piston 26 as previously described, will cause a gradual shifting movement of the piston rod 25 upwardly, the upper portion of the liquid 23 in the upper cylinder 20 will be placed under pressure so that the piston 24, like the piston 26, will offer a certain amount of reaction force to the relative displacement between the bolster and car truck frame. The function of the piston 24 however is an equalizing one as previously described and the major portion of the snubbing action is borne by the lower piston 26. The frusto-conical shape of valve piston 26 with its cooperating surfaces 31, 32 is such that movement of the cylinder 21 relative to valve piston 26 increases the resistance to flow of liquid 23*a* thereby increasing the snubbing force. This snubbing effect is increased in proportion to the amplitude of the forcing movement of the cylinder 21.

In a similar manner, downward movements of the car truck frame relative to the bolster will cause the liquid in the upper and lower portions respectively of the cylinder assemblies 20 and 21 to be placed under pressure with the pistons 24 and 26 offering the desired reaction force as the liquid is slowly bled upwardly through or around the pistons as the case may be.

In compliance with Title 35, U.S. Code, section 22, a preferred embodiment of the invention has been shown in the drawings and described herein, but it should be understood that the invention is not to be limited to the specific disclosure made and that the appended claims should be construed as broadly as the prior art will permit.

I claim:

1. A stabilizing mechanism for damping oscillations of a spring supported body constituting one of a pair of

bodies movable relative to each other from different normal positions, said mechanism comprising an hydraulic equalizing cylinder for attachment to and movable with said spring supported body, a snubbing cylinder for attachment to and having positive movement with the other body, an axially movable thrust rod common to and extending through both cylinders, an equalizing piston secured to said rod within the equalizing cylinder, a combined snubbing piston and valve secured to said rod within the snubbing cylinder, separate bodies of fluid media sealed in the separate cylinders and substantially filling them, means establishing a restricted by-pass for fluid across said equalizing piston, a pair of longitudinally spaced apart valve seats fixed to the inner wall of the snubbing cylinder in equally spaced relation to the combined snubbing piston and valve when the latter is in its neutral position, the said seats serving as stops for abruptly limiting the movements of the combined snubbing piston and valve from its neutral position and also cooperating therewith to define an annular passageway for fluid around the combined snubbing piston and valve, which passageway is progressively restricted by the movement of the said combined piston and valve from its neutral position, whereby the several parts of the mechanism cooperate during relative movements of said cylinders toward and away from each other from assumed normal positions to create increased pressure differentials at opposite sides of said equalizing piston and at opposite sides of said combined snubbing piston and valve and whereby continued movement of said equalizing cylinder and the body to which it is attached is damped by said pressure differential in said equalizing cylinder, and spring means abutting against at least one of said cylinders and effectively engaged with said rod to exert spring force thereon to adjust said combined snubbing piston and valve to its neutral position upon cessation of relative movement of said cylinders.

2. A stabilizing mechanism as set forth in claim 1 characterized in that said longitudinally spaced apart valve seats have frusto-conical surfaces and the perimeter of the combined piston and valve associated therewith is formed with frusto-conical surfaces opposed to the frusto-conical surfaces of said seats and cooperate therewith to define said annular passageway.

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TELESCOPING HYDRAULIC SHOCK ABSORBER

Filed May 19, 1959

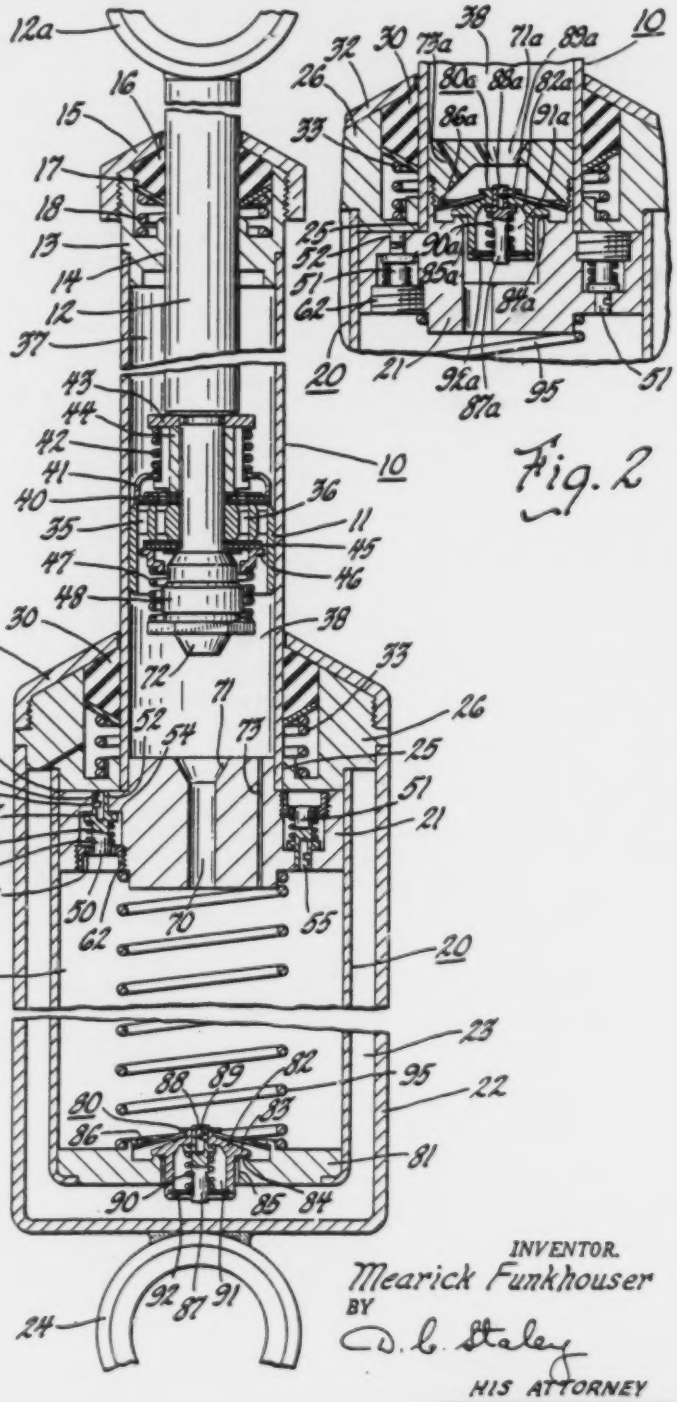

Fig. 1

Fig. 2

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TELESCOPING HYDRAULIC SHOCK ABSORBER

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This invention relates to shock absorbers adapted for connection between the sprung mass or chassis of a vehicle and the unsprung mass or wheel system of the vehicle. More particularly, the invention relates to a direct-acting type shock absorber.

With the trend in motor vehicles being toward lower silhouettes, the clearance provided between the sprung mass or chassis of the vehicle and the unsprung mass or wheel system of the vehicle is being reduced, and while the wheel movement relative to the chassis is also reduced, it is not necessarily in the same amount. This results in less space being available for shock absorber installation.

The space required for shock absorber installation, as far as length is concerned, is the sum of the active and inactive portions of the shock absorber. The active part is that required by the relative movement of the sprung and unsprung masses and is usually referred to as the stroke of the shock absorber, while the inactive part is the difference in length between the stroke and the overall length of the shock absorber which must be included between the appropriate mounting parts of the sprung and unsprung members and is known as the dead length of the shock absorber. When the sprung and unsprung members are in their closest relationship, there must be sufficient clearance provided between these mounting parts to contain the sum of the active and inactive lengths of the shock absorber. In other words, the sum of the active and inactive lengths of the shock absorber must be sufficiently short as to fit within the clearance allowed between the sprung and unsprung members.

It is, therefore, an object of this invention to provide a direct-acting type shock absorber that is capable of providing a larger ratio between the active and inactive parts of the shock absorber. To obtain this result, it is an object of the invention to use a telescoping shock absorber having dual-acting cylinders and pistons of different diameters constructed and arranged in a manner that the small diameter piston and cylinder operate independently of the larger diameter piston and cylinder for a predetermined part of the full stroke of the shock absorber, the two pistons working concurrently during a part of the stroke so that a larger stroke to dead length ratio is obtained than is possible with a conventional shock absorber.

It is another object of the invention to provide a direct-acting type shock absorber that will accomplish the results of the foregoing objects wherein the small diameter piston of the shock absorber engages the large diameter piston at a predetermined point in the stroke of the unit, the pistons being constructed and arranged in a manner to provide for a hydraulic cushion between the pistons during the period of time the pistons are being brought into engagement, thereby lessening the magnitude of the accelerations due to physical engagement of the pistons.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a vertical cross-sectional view of a shock absorber incorporating features of this invention.

FIGURE 2 is a vertical cross-sectional view of a portion of the shock absorber of FIGURE 1 but illustrating a modified arrangement.

The shock absorber illustrated in the drawings is a direct-acting type shock absorber and consists of a first cylinder 10 and a second cylinder 20. The shock absorber also includes a first piston 11 and a second piston 21, the pistons 11 and 21 being reciprocable in the respective cylinders 10 and 20.

The cylinder 10 carries the piston 21 on the lower end thereof so that the cylinder and piston move as a unit when the piston 21 reciprocates in the cylinder 20. Thus, the cylinder 10 functions as a rod member supporting the piston 21. The piston 11 in the cylinder 10 is carried on the lower end of the rod member 12 that projects exteriorly of the cylinder and has a fitting 12*a* on the upper end thereof that is adapted to connect with a suitable fitting, not shown, on the chassis of a vehicle.

The shock absorber cylinder 20 is encircled by a cylindrical container 22 that is in spaced relationship relative to the cylinder 20 thereby forming a reservoir chamber 23 for hydraulic fluid between the cylinder 20 and the chamber 22. The lower end of the chamber 22 carries a fitting 24 that is adapted for connection to a fitting, not shown, on the running gear of the vehicle. Thus the shock absorber will be retained between the sprung mass or chassis of the vehicle and the unsprung mass or running gear by the fittings 12*a* and 24.

The shock absorber cylinder 10 has the upper end thereof closed by a wall member 13 having a bore 14 through which the rod 12 extends to guide the rod in its reciprocable movement in the cylinder. A closure cap 15 is positioned on the closure wall 13 and retains a seal member 16 of elastomeric material between the closure cap and a pressure member 17 retained against the seal member 16 by the compression spring 18.

The lower end of the cylinder 10 is fixedly secured to the piston 21 and passes through a bore 25 in a closure member 26 that closes the end of the cylinder 20 and is engaged by the chamber wall 22 so as to form the closure member for the reservoir chamber 23. Thus, the closure member 26, in effect, forms the guide for the cylinder 10 in its reciprocable movement in the cylinder 20. A seal member 30 of elastomeric material is carried in the closure member 26 and is retained in the seal chamber 31 by a closure cap 32. A compression spring 33 retains the seal member 30 under pressure to effect engagement with the wall of the cylinder 10.

The piston 11 of the small diameter cylinder 10 has a series of openings 35 positioned adjacent the circumference of the piston. A second series of openings 36 are positioned within the radial circle of the openings 35. The openings 35 and 36 provide for flow of hydraulic fluid between the chambers 37 and 38 on opposite sides of the piston 11.

The openings 35 are normally closed by an annular disk valve structure 40 held in engagement with the seats around the openings 35 by means of a valve retainer 41 and a compression spring 42 that is placed between the valve retainer and the washer 43 positioned at the upper end of the spacer member 44 disposed between the washer 43 and the disk valve assembly 40 to hold the disk valve assembly on the upper side of the piston 11.

A disk valve assembly 45 closes the series of openings 36, a valve retainer 46 holding the disk valve assembly 45 on the seats around the openings 36. A spring 47 urges the retainer 46 against the disk valve 45. The spring 47 is held on the lower end of the rod 12 by means of a nut 48 which nut also holds the entire piston and valve assembly on the lower end of the rod 12.

The piston member 21 that is carried on the lower end

of the cylinder 10 is provided with one or more valve members 50 which control displacement of hydraulic fluid from the upper side of the piston 21 from the chamber space 60 into chamber space 61. Similarly, one or more valves 55 control displacement of the hydraulic fluid from the chamber space 61 to the chamber 60 above the piston 21. It will be noted that the valves 50 and 55 are of identical construction but are merely reversed in their direction of operation so as to control flow of hydraulic fluid between the chambers 60 and 61 in opposite directions. Valves 50 and 55 could be replaced by spring loaded disk valves similar to 40 and 45.

Each of the valves 50 and 55 consist of a valve member 51 that slides in a bore 52, an enlarged head 53 seating on a wall seat 54. The valve 51 is retained on the seat 54 by means of the compression spring 56. The valve member 51 has an axial bore 57 connecting with a radial bore or slot 58 so that when the valve 50, for example, is moved downwardly the slot 58 will move above the seal wall 54 and allow hydraulic fluid to pass through the passage 57, slot 58 and thence into the valve chamber 59 and through the openings 62*a* in the member 62 for flow of hydraulic fluid from the chamber space 60 into the chamber space 61.

Since valve member 55 is constructed like valve member 50, it operates in the same manner but controls flow of hydraulic fluid from the chamber space 61 into the chamber space 60.

The piston 21 has a central passage 70 that provides fluid connection between the chamber space 38 in the small diameter cylinder 10 and the chamber space 61 in the large diameter cylinder 20. This passage 70 is of sufficient size that there is substantially no restriction to flow of hydraulic fluid between the chambers 61 and 38.

It may be desirable to place a two-way valve similar to the base valve 80 in this passage 70, as illustrated in FIG. 2, with valve 80*a*.

As is apparent from the drawing, the area of piston 11 is smaller than the area of piston 21. Therefore, to smooth out the transition of control from the volume of fluid displaced by piston 11 to the volume of fluid displaced by both pistons 11 and 21, a valve 80*a*, like valve 80, may preferably be placed in passage 70. That is, with piston 11 doing the work as controlled by the resistance of the base valves 80—87, much less control will be required than when both pistons 11 and 21 are moving together. A tailored balance of control between the valve 80*a* in passage 70 and the base valves 80—87 can readily be established when it is desirable to divide the control between the base valve 80 and the similar valve 80*a* in passage 70.

The upper end of the passage 70 is in the form of a truncated cone 71. A projection 72 is provided on the head of the nut 48 and is also in the form of a truncated cone that cooperates with the truncated cone-shaped recess 71 to fit therein when the piston 11 moves downwardly to drive the piston 21 downwardly. The hydraulic fluid between the surfaces of the cone-shaped parts 71 and 72 will provide a hydraulic cushion between these parts at the time the two surfaces are brought into engagement, thus cushioning the shock of engagement and reducing the impact of engagement.

A restriction passage 73 connects the chambers 61 and 38 so that there will be a pressure balance between these chambers at all times even though the piston 11 is in engagement with the piston 21 and is driving the same, the cone-shaped part 72 closing the passage 70 at this time.

The larger diameter cylinder 20 carries a base valve 80 in the bottom wall 81 thereof, this valve providing for restrictive control of flow of hydraulic fluid from the chamber 61 to the reservoir 23 and relatively free flow of hydraulic fluid in the reverse direction. The valve 80 consists of a valve member 82 provided with a radial flange portion 83 that engages a seat 84 around the opening 85 in the wall 81. The valve member 82 is retained on the seat 84 by means of a light finger spring 86.

The valve member 82 carries a plunger valve 87 slidably supported in the member 82. This plunger valve has a central port 88 that connects with a radial port 89, the valve being held in the position shown in the drawing by a compression spring 90. When hydraulic fluid in the chamber 61 is placed under pressure, the plunger valve 87 will be moved downwardly against the action of the spring 90 until the radial slot 89 connects with the chamber 91 for restrictive control of flow of hydraulic fluid from the chamber 61 through the passage 88 and radial passage 89 into the valve chamber 91, and thence through openings 92 in the washer 93 for admission into the reservoir 23.

When the load is static, the several parts of the shock absorber assume their respective positions as shown in the drawing, compression spring 95 retaining the piston 21 against the closure wall 26.

In operation, the shock absorber piston 11 reciprocates in the cylinder 10 independently of the piston 21 in the cylinder 20 for a portion of the full stroke of the shock absorber allowed by the total length of the cylinder 10. When the shock absorber and the spring supported load are static, the piston 11 is disposed substantially midway between opposite ends of the cylinder 10. Thus, for a portion of the stroke of the shock absorber the piston 10 can operate independently of the piston 21. The resistance to displacement of hydraulic fluid between the chambers 37 and 38 at opposite sides of the piston 11 is controlled by the disk valve assemblies 40 and 45, this resistance to flow of displaced fluid being whatever may be desirable under the particular conditions of operation of the shock absorber.

When the shock absorber is under a compression stroke, that is piston 11 is moving toward the base valve 80, fluid is placed under pressure in the chambers 38 and 61 with sufficient fluid being displaced from the chamber 38 to chamber 37 to compensate for the movement of the piston 11 toward the base valve 80. However, there will be excess fluid that cannot be displaced from the chamber 38 into the chamber 37 because of the entry of the rod 12 into the chamber 37. This excess fluid will be displaced from the chamber 38 through the passage 70 into the chamber 61 and thence through the resistance valve 87 into the reservoir 23. When valve 80*a* is also used, as shown in FIG. 2, the displaced fluid works against the resistance valve 87*a* first and then against resistance valve 87. This valve 87 is modified by the action of valve 87*a*.

When the stroke of the shock absorber exceeds the distance provided between the piston 11 and the piston 21, the end portion 72 of the piston 11 will enter the recess 71 in the piston 21 to effect driving engagement of the piston 11 with the piston 21. During the interval of movement of the projection 72 into engagement with the surface of the recess 71, the film of hydraulic fluid between the respective surfaces will provide a fluid cushion or hydraulic cushion between the surfaces to soften the physical engagement of the projection 72 with the surface 71.

When the projection 72 on the pistons 11 engages the recess 71 in the piston 21, piston 21 will then be moved downwardly in the cylinder 20 to effect displacement of hydraulic fluid from the chamber 61 into the chamber 60 under control of the resistance valving 55. At this time no fluid will be displaced from the chamber 38 into the chamber 37 since relative movement between the piston 11 and the cylinder 10 has now come to a standstill. All additional stroke movement of the shock absorber will occur by movement of the piston 21 toward the base valve 80, piston 11, of course, moving toward the base valve concurrently with the piston 21 since the rod 12 is driving both pistons downwardly.

Since the piston 21 is of larger diameter than piston

11, the displacement of hydraulic fluid for a given movement between the sprung and unsprung masses will be greater than during movement of piston 11 in cylinder 10. At this time cylinder 10 functions as the rod for the piston 20 so that there is a volumetric differential of fluid that will be forced through the resistance valve 87 since downward movement of piston 21 displaces more fluid than can be received in chamber 60.

On the rebound stroke of the shock absorber, that is when pistons 21 and 11 move away from the base valve 80, fluid will be displaced from the chamber 60 through the resistance valve 50 into chamber 61, compression spring 95 urging the piston 21 upwardly to follow upward movement of the rod 12 that carries piston 11 and cylinder 10. When piston 21 reaches the position shown in the drawing, piston 11 will then move upwardly in the cylinder 10 independent of any connection with piston 21. All fluid required to refill the chambers 60 and 38 will be obtained from the reservoir 23 through the valve member 83 being lifted from its seat against the light finger spring 86, this return flow being relatively free, and in the case of FIG. 2, through valve member 83*a*. It will be understood, of course, that valves 53 and 45 will be effective to control relative movements between pistons 11 and 21 on this return stroke. A hydraulic cushion similar to that provided by the projection 72 and recess 71 can be provided between the head of piston 11 and the end closure wall 13.

From the foregoing description it will be apparent that the total length of a shock absorber providing the same stroke can be considerably less than if a uniform diameter cylinder is used since a part of the stroke of the shock absorber is effected under control of the large diameter piston 21. The portion of the full stroke of the shock absorber taken by the respective pistons 10 and 11 can be varied to meet requirements and the ratio of the diameters of the pistons 11 and 21 can be varied to control the maximum stroke of the shock absorber.

While the embodiments of the present invention as herein disclosed constitute a preferred form, it is to be understod that other forms might be adopted.

What is claimed is as follows:

1. A telescoping hydraulic shock absorber, comprising, first and second cylinders the first of which is reciprocable within the second, first and second pistons reciprocable in the second and first cylinders respectively, the first of which pistons is attached to said first cylinder for reciprocal movement therewith in said second cylinder and the second of which pistons is reciprocable in said first cylinder by rod means extending from the said first cylinder, said second piston being reciprocable independently of said first piston and engageable with said first piston to effect movement thereof therewith in the second of said cylinders, said cylinders having hydraulic connection between compression chamber portions thereof at comparable sides of the respective pistons for the cylinders, each of said pistons having valve means controlling flow of hydraulic fluid between opposite sides of the said pistons on compression and rebound stroke thereof as displaced by movement of the respective pistons, and closure means at one end of said second cylinder including valve means therein between the same and a hydraulic fluid reservoir means providing for controlled flow of hydraulic fluid to said reservoir means from either of the compression chambers of said cylinders as displaced on compression stroke by movement of either of said pistons and substantially free return of fluid from said reservoir to either of the said compression chambers on rebound stroke.

2. A telescoping hydraulic shock absorber, comprising, first and second cylinders the first of which is reciprocable within the second, first and second pistons reciprocable in the second and first cylinders respectively, the first of which pistons is attached to said first cylinder for movement therewith and the second of which pistons is reciprocable in said first cylinder by rod means extending from the said first cylinder, said second piston being reciprocable independently of said first piston and engageable with said first piston to effect movement thereof therewith in the second of said cylinders, said cylinders having free hydraulic connection between compression chamber portions thereof at comparable sides of the respective pistons for the cylinders through said first piston when said pistons are spaced from each other, valve means for each of said pistons controlling flow of hydraulic fluid between opposite sides of the respective pistons on compression and rebound stroke thereof as displaced by movement of the respective pistons, and closure means at one end of said second cylinder including valve means therein between the same and a hydraulic fluid reservoir means providing for controlled flow of hydraulic fluid to said reservoir means from either of the compression chambers of said cylinders as displaced on compression stroke by movement of either of said pistons and providing for relatively free return flow of hydraulic fluid from the reservoir means to either of said compression chambers of said cylinders on rebound stroke of said pistons.

3. A telescoping hydraulic shock absorber, comprising, first and second cylinders the first of which is reciprocable within the second, first and second pistons reciprocable in the second and first cylinders respectively, the first of which pistons is attached to said first cylinder for movement therewith and the second of which pistons is reciprocable in said first cylinder by rod means extending from the said first cylinder, said second piston being reciprocable independently of said first piston and engageable with said first piston to effect movement thereof therewith in the second of said cylinders, said cylinders having free hydraulic connection between compression chamber portions thereof at comparable sides of the respective pistons for the cylinders through said first piston until said second piston engages said first piston and closes said connection, valve means for each of said pistons for controlling flow of hydraulic fluid between opposite sides of the said pistons on compression and rebound stroke as displaced by movement of the respective pistons, and closure means at one end of said second cylinder including valve means for said second cylinder between the same and a reservoir means providing for controlled flow of hydraulic fluid to said reservoir means from either of the compression chambers of said cylinder as displaced on compression stroke by movement of either of said pistons and providing for relatively free return flow of hydraulic fluid from the reservoir means to either of said compression chambers of said cylinders on rebound stroke of said pistons, and additional passage means through said first piston providing hydraulic fluid connection between said compression chambers of said cylinders at all times to maintain thereby hydraulic pressure balance in the said cylinders during movement of the said pistons together.

4. A telescoping hydraulic shock absorber, comprising, first and second cylinders the first of which is reciprocable within the second, first and second pistons reciprocable in the second and first cylinders respectively, the first of which pistons is attached to said first cylinder for movement therewith and the second of which pistons is reciprocable in said first cylinder by rod means extending from the said first cylinder, said second piston being reciprocable independently of said first piston and engageable with said first piston to effect movement thereof in the second of said cylinders, each of said pistons having valve means therein respectively controlling flow of hydraulic fluid between opposite sides of the said pistons on compression and rebound stroke thereof as displaced by movement of the respective pistons, additional independently acting valve means in said first piston controlling flow of hydraulic fluid from the compression chamber of said first cylinder into the compression chamber of said second cylinder on displacement of fluid from said first cylinder by said second piston into said second cylinder and providing for relatively free return flow of

hydraulic fluid from the compression chamber of said second cylinder into said first cylinder on rebound stroke of said second piston in said first cylinder, and additional valve means in said second cylinder providing controlled flow of hydraulic fluid from the compression chamber of either of said cylinders to reservoir means as displaced by movement of either or both of said pistons and providing relatively free return flow of hydraulic fluid from the reservoir means to the compression chambers of both of said cylinders.

5. A telescoping hydraulic shock absorber constructed and arranged in accordance with claim 3 that includes resilient means in said second cylinder normally positioning said first piston at the end of said second cylinder remote from the valved closure end thereof with said second piston being positioned intermediate the ends of said first cylinder under static conditions.

6. A telescoping hydraulic shock absorber, comprising, first and second cylinders one of which is reciprocable within the other, first and second pistons reciprocable in the first and second cylinders respectively, one of which pistons is attached to said one cylinder for movement therewith and the other of which pistons is reciprocable in said one cylinder by rod means extending from the said one cylinder, the said one cylinder providing rod means for said one piston attached thereto, the said pistons and their cooperating rod means providing for differential displacement of hydraulic fluid in their respective cylinders on reciprocation of the said pistons in their respective cylinders, valve means on each of said pistons controlling flow of hydraulic fluid between opposite sides of the said pistons as displaced by movement of the pistons in their respective cylinders, said cylinders having hydraulic connection between compression chamber portions thereof at comparable sides of the respective pistons for the cylinders positioned in said one piston and providing for free flow of hydraulic fluid between said compression chambers of said cylinders during reciprocation of said other piston independently of said one piston and which is closed when said one piston is engaged by said other piston for concurrent movement therewith, and means in said other cylinder providing for controlled flow of hydraulic fluid from both of said compression chambers of said cylinders to reservoir means on the shock absorber as displaced by movement of either of said pistons in their respective cylinders and providing for relatively free return flow of hydraulic fluid from the reservoir means to both of said compression chambers of said cylinders on movement of the respective pistons away from the said last-mentioned valve means.

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Aug. 18, 1964 J. H. CARTER 3,145,055

SPRING MOTOR OPERATED TILTING DUMP TRUCK

Filed Feb. 12, 1959

Fig 2

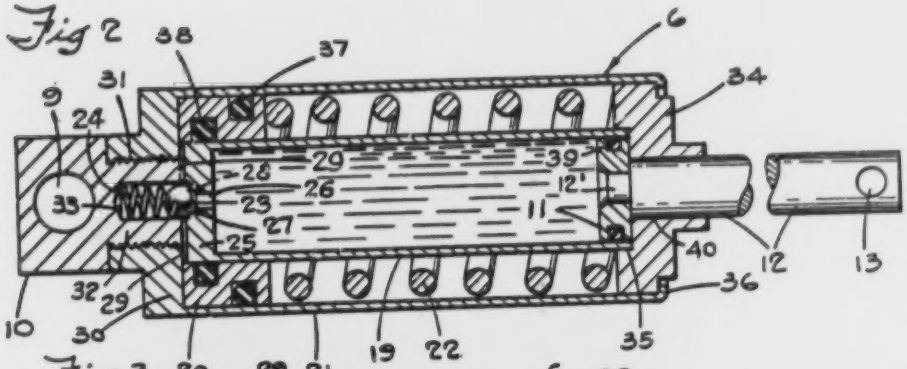


Fig 3

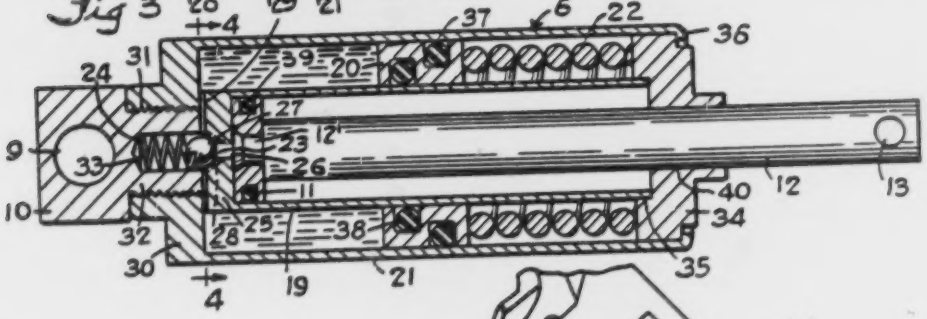


Fig 1

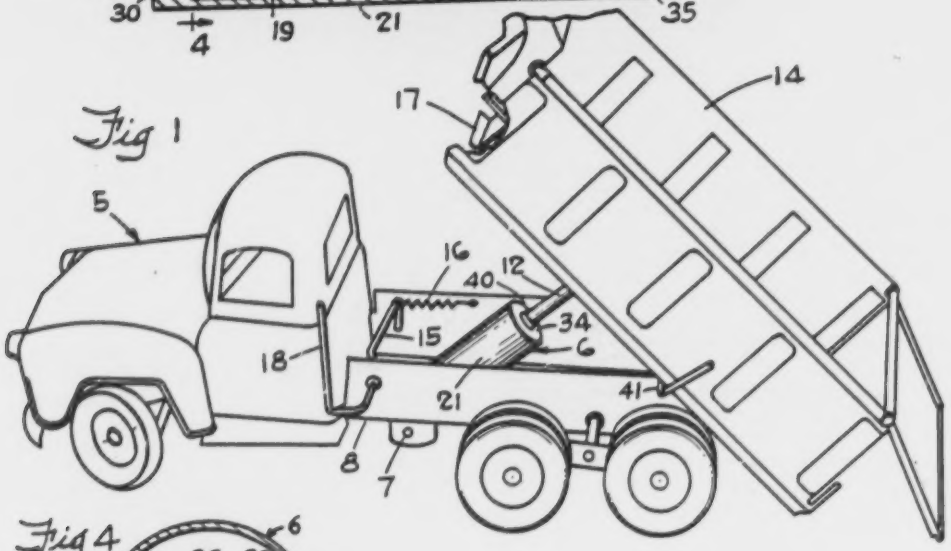
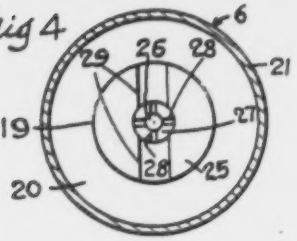


Fig 4



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PLAINTIFF'S EXHIBIT 72

United States Patent Office

3,145,055

Patented Aug. 18, 1964

3,145,055

SPRING MOTOR OPERATED TILTING DUMP TRUCK

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Filed Feb. 12, 1959, Ser. No. 792,734
10 Claims. (Cl. 298—22)

This invention relates to a dual hydraulic piston and cylinder mechanism, which, while herein disclosed as a spring motor applied to a toy dump-truck, for which application it was specially designed, is adapted for use also in door checks and closers, and the like, and wherever a relatively long stroke for the operated piston is required, while a relatively short and compact mechanism is essential or at least advantageous.

Toy dump-trucks with hydraulically operated pistons for operating the dump body became veritable "booby traps" when a certain amount of fluid leaked out of the cylinder, because when the body catch was released under such conditions the spring in the absence of the necessary fluid to slow down the working piston would operate it at high speed, so that a child could easily sustain a serious injury by contact with the dump body under those conditions. Injuries due to this defect in design and construction became so common that retailers, with good reason, refused to deal in hydraulic toys for a long time. It is, therefore, the principal object of my invention to provide an improved design and construction in which the piston is operable solely by fluid, and, in the event any of the fluid leaks out, the only noticeable effect is a reduction in the length of the stroke of the piston, and there is definitely no longer any possibility of injury to the operator.

The long piston stroke is obtained in accordance with my invention by having the working piston disposed in an inner cylinder of smaller diameter, while an outer concentric cylinder of larger diameter (and larger capacity per unit of length) contains the power spring and an annular piston operated thereby to deliver fluid from in front of the piston under pressure of the spring at a controlled rated to the inner cylinder to move the working piston, the moderate speed of the piston being positively assured by the seating of a spring-pressed check-valve, leaving only a small bleeder port open for passage of fluid into the inner cylinder from the outer cylinder. This check-valve unseats in the return movement of the working piston so that there is no interference with the speedy return of the dump body by hand to loading position.

The invention is illustrated in the accompanying drawing, in which—

FIG. 1 is a perspective view of a toy dump-truck equipped with a dual hydraulic piston and cylinder mechanism made in accordance with my invention for the safer operation of the dump body regardless of possible leakage of fluid from the piston and cylinder mechanism;

FIGS. 2 and 3 are longitudinal sections through the piston and cylinder mechanism showing the parts in the opposite extreme positions, FIGURE 3 being the one extreme prior to release of the dump body catch with the piston holding its rod fully retracted, and FIGURE 2 the other extreme at the end of the operation of the dump body with the piston holding its rod fully extended, and

FIG. 4 is a cross-section on the line 4—4 of FIG. 3.

The same numerals are applied to corresponding parts throughout the views.

Referring to the drawing, the toy dump-truck indicated generally by the reference numeral 5 in FIG. 1 is of the conventional design and construction similar to that disclosed in Wood Patent No. 1,602,424, but, in contrast to the undependable single piston and cylinder of that

patent, is shown equipped with a dual hydraulic piston and cylinder mechanism made in accordance with my invention and indicated generally by the reference numeral 6. A horizontal cross-pin 7 suitably supported on the frame 8 extends through a hole 9 in the plug 10 provided on one end of the mechanism 6 for pivotal connection of one end of the mechanism with the frame, and the working piston 11 of the mechanism 6, which is fixed on the reduced and upset inner end 12' of the rod 12 in the manner shown, has the outer end of its rod 12 pivotally connected at 13 with the bottom of the rearwardly tiltable dump body 14 intermediate the ends thereof to tilt the body rearwardly for dumping, as seen in FIG. 1. The frame 8 is referred to elsewhere as the fixed one of two "relatively movable parts" and the dump body 14 as the other or movable one of said "relatively movable parts." A U-shaped catch 15 pivotally mounted in the frame 8 has a tension spring 16 normally urging the same in a clockwise direction toward engagement with a lug 17 provided on the front end of the dump body 14, the catch being so arranged with respect to the lug that it will be swung forwardly out of the way as the dump body is swung downwardly by hand to its normal loading position, and will under tension of the spring 16 swing back into position over the lug 17 to lock the body in place automatically and hold it in that position until the release level 18 is swung forwardly by the operator to release the catch 15 and allow the dump body to be tilted by means of the working piston 11 under hydraulic pressure. The long stroke of the piston 11 substantially the full length of the mechanism 6 necessary for the tilting of the dump body 14 to the extent shown is made possible by the dual piston and cylinder construction shown in FIGS. 2–4, and with this construction I also obtain absolute safety of operation, as will soon appear, because the piston 11 is not operated directly by a spring, as in the prior constructions referred to above but depends for its operation upon the delivery of the oil or other working fluid to the inner cylinder 19 in response to movement of the annular piston 20 in the outer cylinder 21 under pressure of the power spring 22, the oil flow in this direction being regulated by a check-valve 23, so that the working piston 11 can move only as far as the available supply of oil or other working fluid will permit and cannot possibly move fast enough to give rise to any danger of injury to the operator, the oil flow being positively restricted by the seating of the check-valve 23 under the action of its associated spring 24.

Referring to FIGS. 2–4, to separate the inner ends of the two cylinders 19 and 21, the inner cylinder 19 is closed by a wall 25 at its inner end and an opening 26 is provided therein behind a tapered seat 27 for the ball check-valve 23. Bleeder ports 28 are defined by radial grooves in the seat 27 allowing restricted flow of oil under pressure of spring 22 past the check-valve 23 and into the front end of cylinder 19 when the check-valve 23 is seated. One or more larger radial grooves 29 are provided in the outer side of the end wall 25 to deliver oil to the adjacent end of the outer cylinder 21 in front of the annular piston 20 when the working piston 11 moves inwardly on its return stroke as the body 14 is lowered by hand, expelling oil from the inner cylinder past the unseated check-valve 23. The oil entering the outer cylinder under pressure forces the annular piston 20 to the rear, compressing the power spring 22 to load it for the next dumping operation. The front end wall 30 of the cylinder 21 forms an abutment for the front end 25 of the inner cylinder 19 and has a threaded center hole 31 in which the reduced threaded portion 32 of the plug 10 is threaded. An axial bore 33 in the inner end of the plug accommodates the coiled compression spring 24 that

holds the check-valve 23 normally seated. A plug 34, which has the rod 12 slidable freely in a center hole provided therein at 40 so that there is no noticeable air-cushion action in the operation of the piston 11, forms a closure for the open rear ends of both cylinders and has a central depression 35 in which the open end of the inner cylinder 19 is engaged and centered accurately relative to the outer cylinder 21, the rear end of the latter extending slightly beyond the plug and being swedged inwardly, as at 36, to complete the assembly and hold all of the assembled parts together. The oil or other liquid used can be put in cylinder 19 through opening 26 before check valve 23 and plug 10 are put in and while piston 11 is in fully retracted position, as in FIG. 2. Oil or other liquid can also be added through this same opening 26 in the extent of leakage.

O-rings 37 and 38 are entered in annular grooves provided in the outer and inner peripheries of the annular piston 20, respectively, to prevent oil leakage past the piston by contact with the inside of cylinder 21 and outside of cylinder 19. Another O-ring 39 is provided in an annular groove in piston 11 for a similar purpose.

In operation, with the dump body 14 swung down about its pivot 41 and latched at 15–17, the parts are disposed as seen in FIG. 3, power spring 22 being loaded as a result of the previous downward movement of the dump body 14 by hand. When the catch 15 is released, oil under pressure of spring 22 is delivered at a predetermined rate past check-valve 23 through the bleeder ports or grooves 28, moving piston 11 outwardly and swinging the body 14 upwardly slowly, similarly as occurs in large dump-trucks. There is no danger whatever of the piston 11 moving too fast and causing an injury to the operator. If any of the oil leaks out, the dump body 14 will not be tilted quite as far, but otherwise the operation is the same. In the resetting of the dump body, the piston 11 is moved inwardly fast, the oil in front thereof being expelled past the open check-valve 23 and forcing the piston 20 outwardly and loading the power spring 22.

In closing, it will be obvious that the dual hydraulic piston and cylinder mechanism 6 could be used also in a door check or door closer, and wherever a piston having a relatively long stroke and the other operating characteristics described is required or would be advantageous.

It is believed the foregoing description conveys a good understanding of the objects and advantages of my invention. The appended claims have been drawn to cover all legitimate modifications and adaptations.

I claim:

1. A dual piston and cylinder structure comprising two cylinders having inner and outer ends, the inner ends having a wall separating them with openings provided therein through which said cylinders have communication, check valve means housed in said wall cooperating with said openings to control fluid flow between said cylinders to provide a certain rate of flow in one direction between said cylinders with said check valve means seated and a different rate of flow in the opposite direction with said check valve means unseated, the outer ends of said cylinders having walls therein, a piston reciprocable in one of said cylinders having a rod connected therewith and extending through an opening provided in the outer end wall thereof, a piston reciprocable in the other of said cylinders, and a spring compressible between said last named piston and the outer end wall of said last named cylinder.

2. A structure as set forth in claim 1, including a fill opening for hydraulic fluid provided in said first mentioned wall communicating with the first of said cylinders from outside of said cylinders, and a closure for said opening.

3. A structure as set forth in claim 1, including a fill opening for hydraulic fluid provided in said first mentioned wall communicating with the first of said cylinders from outside of said cylinders, and a closure for said opening, said closure being removable and [illegible]ceable so as to permit replenishing hydraulic fluid in event of leakage.

4. A structure as set forth in claim 1, wherein said cylinders are concentrically arranged, the spring pressed piston being annular and disposed in the outer one of said cylinders and the spring being coiled and being disposed in the outer cylinder behind the piston and encircling the inner cylinder.

5. A structure as set forth in claim 1, including hydraulic fluid in said cylinders between said pistons, whereby movement of one piston is transmitted through the intervening fluid to or from the other piston.

6. A dual piston and cylinder structure comprising an inner cylinder and an outer cylinder surrounding the same in rigid relationship thereto, end wall means closing one end of said cylinders, a piston reciprocable in the inner cylinder having a rod connected therewith and extending through an opening provided therefor in said end wall means, a piston reciprocable in the outer cylinder and arranged to compress a spring disposed in said outer cylinder between said piston and said end wall means, a second end wall means closing the other end of said cylinders and having openings provided therein through which the last mentioned end of said cylinders have communication, check valve means cooperating with said openings to control fluid flow between said cylinders to provide a certain rate of flow in one direction between said cylinders with said check valve means seated and a different rate of flow in the opposite direction with said check valve means unseated, and an end closure secured to the last named end wall means serving as a housing for said check valve means and as a closure for that end of said cylinders.

7. A structure as set forth in claim 6, including hydraulic fluid in said cylinders between said pistons, whereby movement of one piston is transmitted through the intervening fluid to or from the other piston.

8. A structure as set forth in claim 7, wherein the last named end closure and check valve means are both removable to enable filling the inner cylinder with hydraulic fluid or replenishing such fluid in event of leakage.

9. A structure as set forth in claim 6, wherein the last named end wall means comprises a separate inner end wall on one end of the inner cylinder with a port provided therein, and a separate outer end wall on the corresponding end of the outer cylinder abutting the inner end wall, the end closure closing an opening provided in the outer end wall which communicates with the port provided in the inner end wall, the check valve means cooperating with the latter port in the inner end wall.

10. In combination, a dump vehicle comprising a frame, a body pivoted with respect to said frame for tilting to dumping position, latch means releasably locking said body in lowered position relative to said frame, and a spring motor for said vehicle pivotally connected on one hand with said frame and on the other hand with said body, said motor comprising an inner cylinder and an outer cylinder surrounding the same in rigid relationship thereto, end wall means closing one end of said cylinders, a piston reciprocable in the inner cylinder having a rod connected therewith and extending through an opening provided therefor in said end wall means for pivotal connection to one of said body and frame, a piston reciprocable in the outer cylinder and arranged to compress a spring disposed in said outer cylinder between said piston and said end wall means, a second end wall means closing the other end of said cylinders and having openings provided therein through which the last mentioned end of said cylinders have communication, check valve means cooperating with said openings to control fluid flow between said cylinders to provide a certain rate of flow in one direction between said cylinders with said check valve means seated and a different rate of flow in the opposite direction with said check valve means un-

seated, and an end enclosure secured to the last named end wall means serving as a housing for said check valve means and as a closure for that end of said cylinders, said end closure being pivotally connected to the other of said body and frame.

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Nov. 7, 1967 W. T. BLAKE 3,351,336

RAILROAD CAR SHOCK ABSORBER

Filed Aug. 19, 1964 4 Sheets-Sheet 1

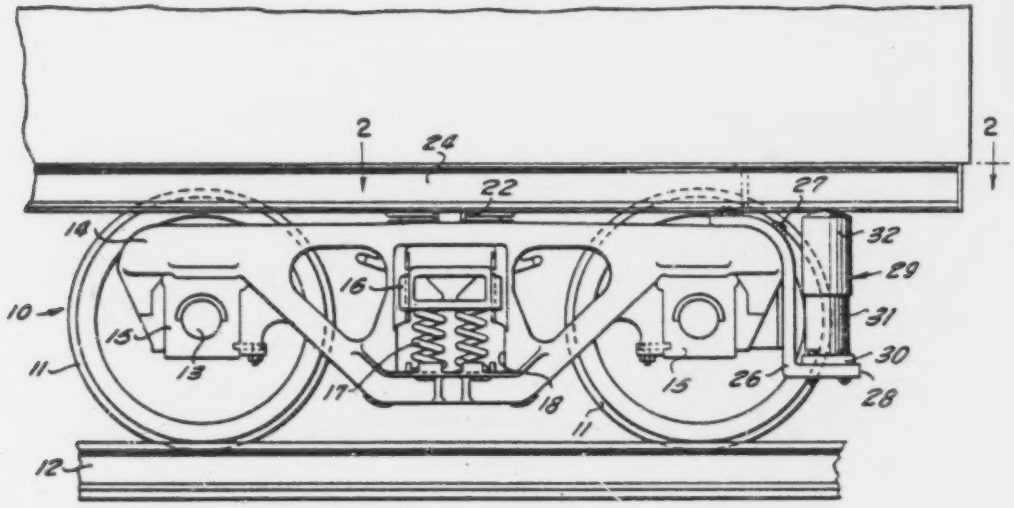

Fig. 1

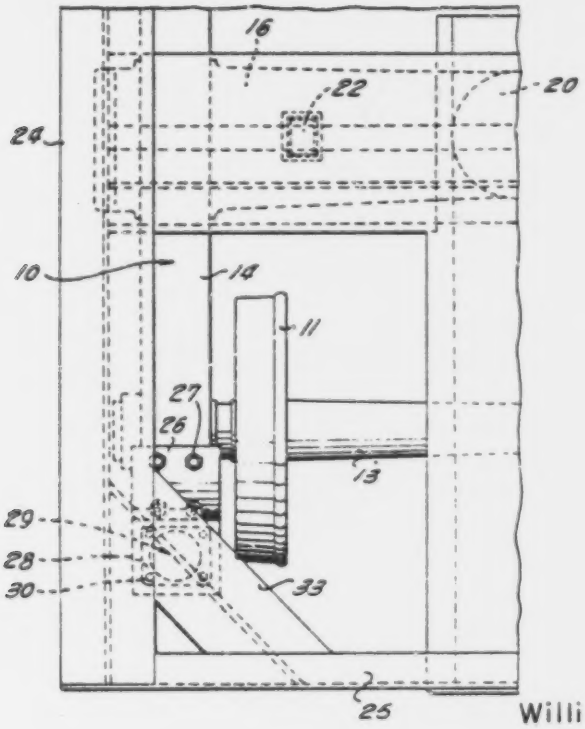

Fig. 2

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PLAINTIFF'S EXHIBIT 73

Nov. 7, 1967 W. T. BLAKE 3,351,336

RAILROAD CAR SHOCK ABSORBER

Filed Aug. 19, 1964 4 Sheets-Sheet 2

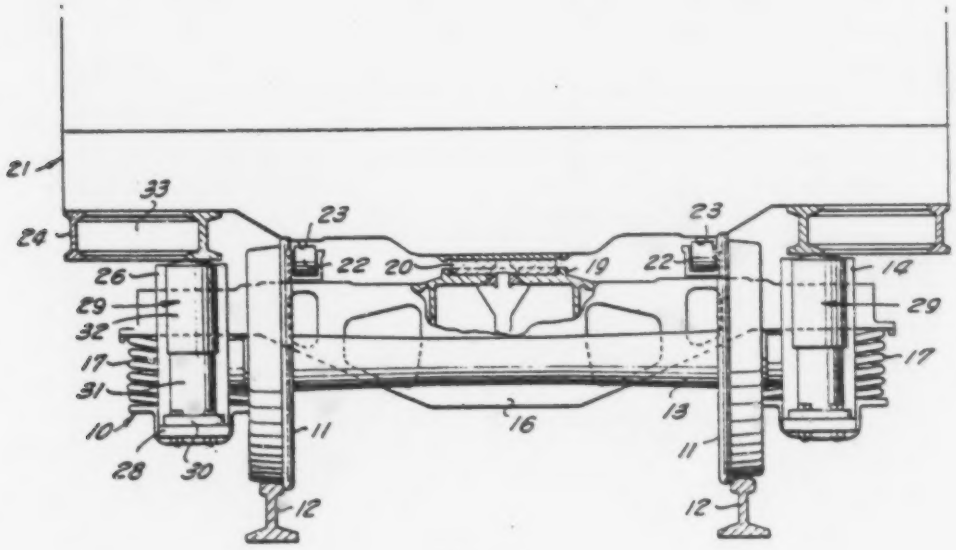

Fig. 3

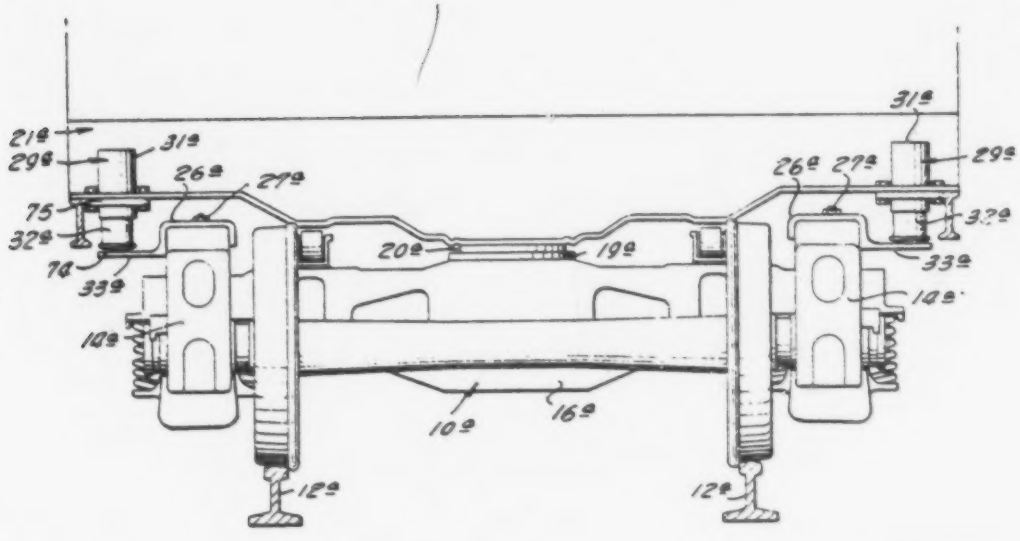

Fig. 4

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RAILROAD CAR SHOCK ABSORBER

Filed Aug. 19, 1964 4 Sheets-Sheet 3

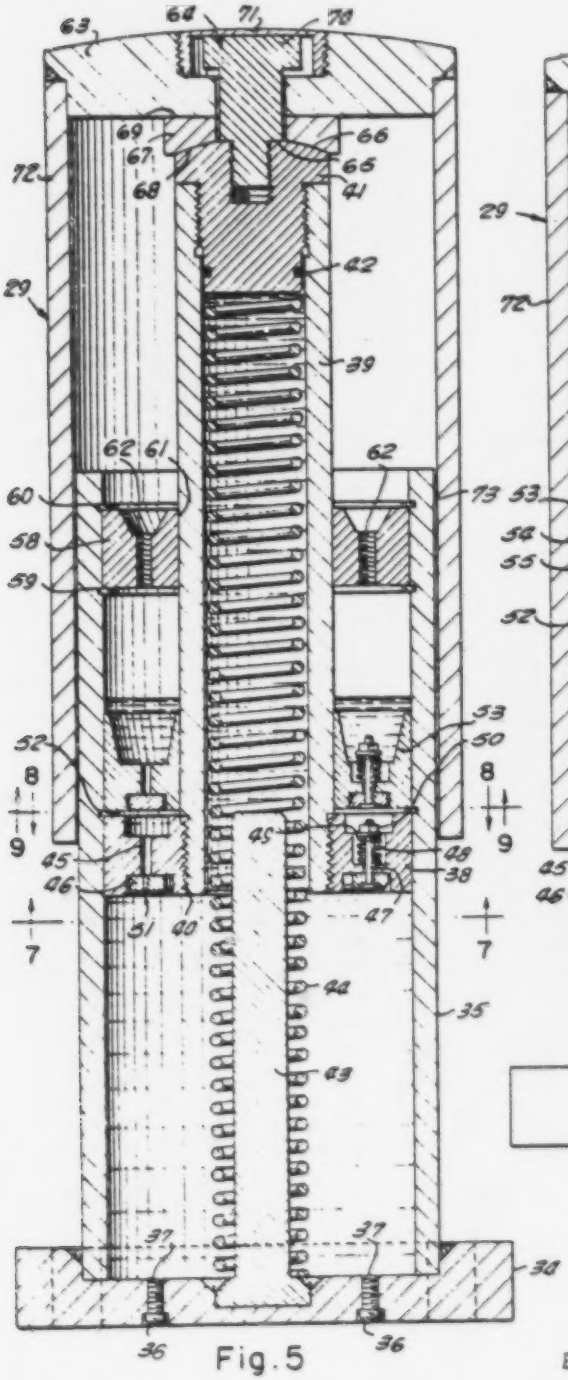

Fig. 5

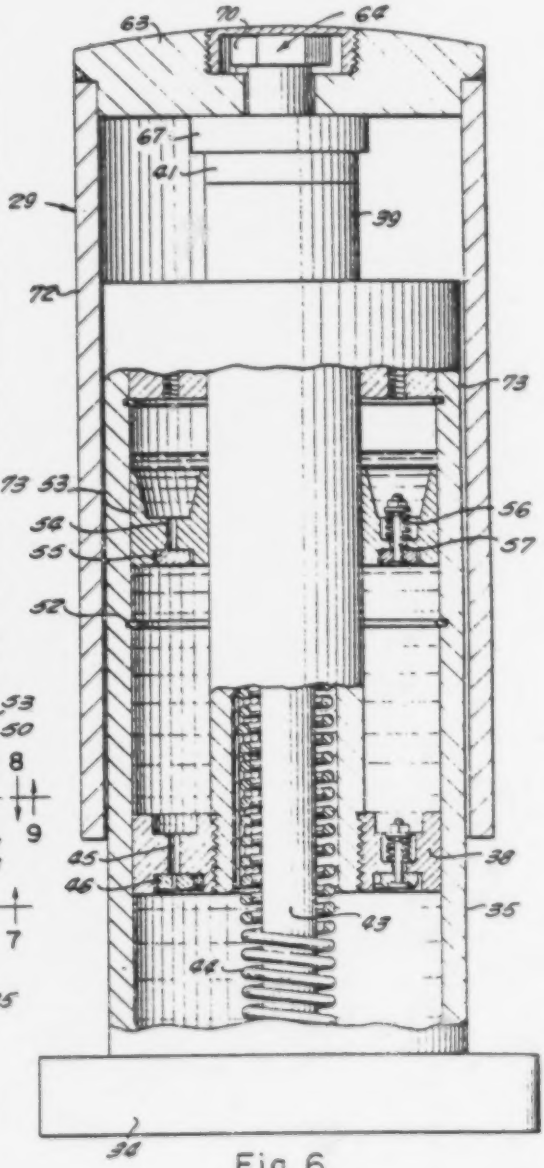

Fig. 6

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RAILROAD CAR SHOCK ABSORBER

Filed Aug. 19, 1964 4 Sheets-Sheet 4

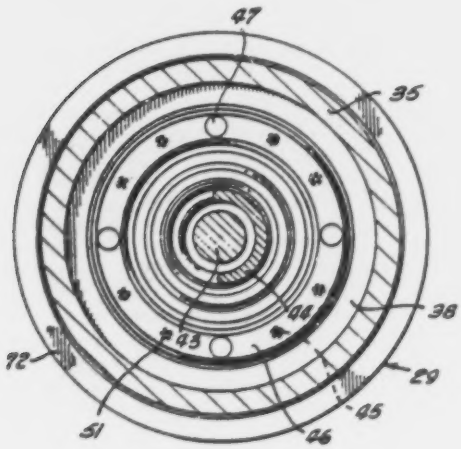

Fig. 7

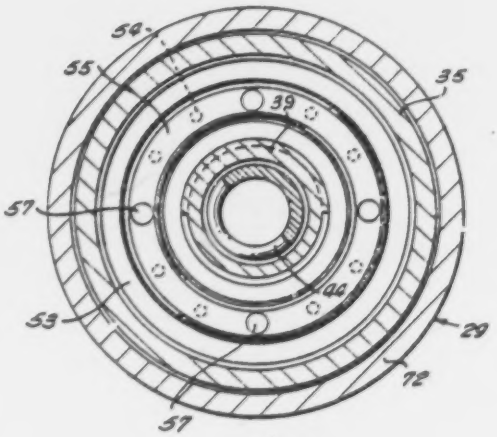

Fig. 9

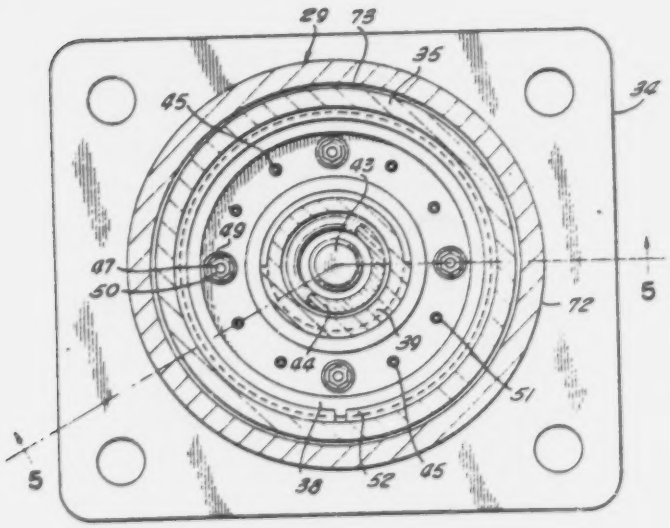

Fig. 8

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3,351,336

Patented Nov. 7, 1967

3,351,336

RAILROAD CAR SHOCK ABSORBER

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Filed Aug. 19, 1964, Ser. No. 390,562
5 Claims. (Cl. 267—3)

This invention relates to shock absorbers especially for railroad cars, and to railroad cars equipped with shock absorbers for controlling motions of the car body with respect to the trucks.

Railroad cars, such as freight cars, when running on a track are often damaged, but the car lading is damaged more frequently. Important causes of such damage are the rolling, bouncing, or pitching motions of the car bodies, or combinations of any two or all three of these motions. Roughness of the track, even though slight, may impart large swings to the car body. Thus, when a car hits waves in a track with a frequency corresponding to the natural frequency of motion of the car body on the trucks, the car body lurches violently. Sometimes this lurching extensively damages the lading and the car, and it can, if severe, derail the car.

The main object of the invention is to provide a railroad car, particularly a freight car, in which movements of the car body on the trucks are kept within acceptable limits.

Another object is to provide a railroad car that rides smoothly over the rails, whereby the chances of damaging the car lading and the car itself are low.

Another object of the invention is to provide a railroad car that is cushioned against side sway and other body motions without interference with the turning of the trucks.

Another object is to enable existing railroad cars to be readily altered to provide a car in accordance with the invention.

Yet another object is to provide a side sway cushioning arrangement that is easily installed in the building of a railroad car.

Still another object of the invention is to provide a railroad car having a side sway cushioning system that is reliable and simple to maintain, and that has a long service life.

Another object of the invention is to provide a hydraulic shock absorber that is especially adapted for use in controlling railroad car body movements.

Another object is to provide a hydraulic shock absorber in which the hydraulic liquid is prevented from foaming.

Still another object is to provide a hydraulic shock absorber that operates without forming an internal vacuum.

Certain of the foregoing and such other objects of the invention as appear hereinafter are attained in a railroad car having a car body structure; and a truck having wheels, an unsprung frame structure, and means supporting the car body structure for pivotal movement on the truck about a substantially vertical axis, the supporting means including resilient means permitting rolling, pitching and bouncing of the car body structure on the unsprung frame structure. A pair of shock absorbers or car stabilizers is provided, each stabilizer having a pair of relatively movable members, a body of liquid, and means metering the liquid to absorb energy as the members are moved. The car stabilizers are mounted at opposite sides of the pivotal axis of the car body structure to absorb energy of movement of the car body structure towards the unsprung frame structure. The mounting means for the stabilizers includes means fixing one of the movable members of each car stabilizer to one of the foregoing structures, and means permitting sliding movements of the other movable

members of the car stabilizers on the other of the structures as the car body structure pivots on the truck.

Other objects of the invention are realized in a hydraulic, shock absorbing mechanism including a cylinder; a cylinder head closing one end of the cylinder; a piston slidable in the cylinder; means providing for the flow of fluid from side to side of the piston as the piston is reciprocated in the cylinder; a piston shaft carried by the piston and extending away from the cylinder head; and an annular piston slidingly mounted on the shaft and slidable in the cylinder.

In the drawings:

FIG. 1 is a fragmentary side view of one end of a railroad boxcar embodying the invention;

FIG. 2 is a partial sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a right end view of the car shown in FIG. 1, with parts broken away;

FIG. 4 is a view similar to FIG. 3 of a railroad car embodying another form of the invention;

FIG. 5 is an axial sectional view taken along the line 5—5 of FIG. 8 of a shock absorber or stabilizer embodying the invention, the view showing positions of the parts when the piston shaft is fully extended;

FIG. 6 is an axial sectional view also taken along the line 5—5 of FIG. 8 showing the position of the parts when the piston shaft is moved partly into the cylinder;

FIG. 7 is a sectional view taken on the line 7—7 of FIG. 5;

FIG. 8 is a sectional view taken on the line 8—8 of FIG. 5; and

FIG. 9 is a sectional view taken on the line 9—9 of FIG. 5.

Referring to FIGS. 1 to 3, the railroad boxcar shown is conventional, except for certain added components that are combined with the car, which added components will be identified hereinafter. As is typical of railroad freight cars, the illustrated car has a truck 10, including wheels 11, 11, 11, 11 that ride on track rails 12, 12. The wheels are sweated to parallel axles 13, 13 upon the outer ends of which the side frames 14, 14 are carried by journal boxes 15, 15, 15, 15. The wheels, axles, side frames, and journal boxes are unsprung components of the truck; that is, there are no resilient or cushioning devices between these parts and the track rails.

The truck further includes a transverse bolster 16. Springs 17, 17 are mounted on the side frames in openings 18, 18, and resiliently support the bolster at its ends. At the top center of the bolster is a pivot bearing having a low element 19 on the bolster and a complementary upper element 20 on the car body 21. The bolster also has a pair of rollers 22, 22 mounted on it outwardly from the pivot bearing. These rollers are adapted to engage flat surfaces 23, 23 on the car body to limit tilting of the car body on the bolster.

The body has the usual longitudinal frame members 24 and end frame members 25.

In accordance with the invention, the car heretofore described is modified by the addition of hydraulic shock absorbers. As thus modified, each side frame has a bracket 26 attached to its by bolts 27, 27. A platform 28 at the bottom of the bracket carries a single-acting, quick-return, hydraulic shock absorber 29. The shock absorber has a base 30 bolted to the platform, a fixed member 31, and a relatively movable member 32 that is vertically reciprocable on the fixed member. The top of the movable member bears against a horizontal flat surface on the bottom of the car body. This flat surface is provided in part by a wear beam 33, welded between a longitudinal frame member 24 and an end frame member 25 of the car body, and

in part by the flat bottom surfaces of the longitudinal and the end frame members themselves. This flat surface slides on the top of the shock absorber as the car body pivots on the truck.

Although the details of construction and of operation of the shock absorber will be fully described hereinafter, a brief statement here will help the reader understand how the car works. The movable member of the shock absorber is urged upwardly against the wear beams by an internal spring. When the movable member is pushed down, high resistance to movement is encountered and energy is absorbed in the shock absorber. And when the movable member is released, the internal spring quickly moves it up against low resistances.

While only one end of a boxcar is shown in the drawings, it will be understood that the other end of the boxcar is similar. It has a truck like the truck **10**, but this truck faces in the opposite direction so that the shock absorbers are located as close as possible to the near end of the car body.

Normal pivoting of the car body on the trucks is not affected by the absorbers. Moreover, the shock absorbers acts in their intended way whether the car is running on a straight or curved section of track, or whether it is going into or coming out of a curve. These desirable characteristics are present because the wear beams of the car slide with little effort over the tops of the shock absorbers, allowing the shock absorbers to adjust themselves to the various angular positions taken by the trucks

Referring to FIG. 4, showing a railroad car embodying another form of the invention, the car, apart from the shock absorber installation, is the same as the car in FIGS. 1 to 3. It has a truck **10***a* at either end, the trucks riding on rails **12***a*. The truck has side frames **14***a*, **14***a* and a pivot bearing **19***a*, **20***a* supporting a car body **21***a*.

Shock absorbers **29***a*, **29***a* are carried by the car body. Each shock absorber has an upper fixed member **31***a* having a base **30***a* which is bolted onto the car body. Each shock absorber also has a lower movable member **32***a* which slides in an arcuate path on the flat top surface of a wear plate **33***a* as the car body pivots on the trucks. This wear plate has an integral bracket **26***a* which is attached to the side frame **14***a* by bolts **27***a*, **27***a*. The shock absorbers **29***a*, **29***a* are in line with the bolster **16***a* when the truck is squared with the car, so that they bear down along a line extending across the truck at its center.

Shock absorbers **29***a*, **29***a* function similarly to their counterparts **29**, **29**. The movable members **32***a*, **32***a* are biased into contact with the wear plates by internal springs (not shown). When these movable members are forced upwardly into the fixed members **31***a*, they move against the resistance of hydraulic fluid flowing through metering orifices, whereby energy is absorbed and dissipated. And when the movable members are moved down by the internal springs, they move quickly and against low resistance to maintain their contact with the wear plates.

The shock absorbers **29***a* control the motions of the car **21***a* in about the same way as the shock absorbers **29** control the motions of the car **21**, all as described hereinbefore. It is thought unnecessary to repeat that description here, as the operation of the car of FIG. 4 will be obvious from the earlier description.

An embodiment of the invention as it relates to shock absorbers will now be described with reference to FIGS. 5 to 9. The illustrated shock absorber **29** has a rectangular base **34** to which is welded a cylinder **35**, the base forming a head for the bottom of the cylinder. Removable plugs **36**, **36** are screwed into tapped openings **37**, **37**, through which hydraulic fluid may be put into the cylinder.

A piston **38** is slidably fitted in the cylinder. The piston has a shaft **39** screwed into a threaded central opening **40** in the piston. The shaft is tubular, it being open at the bottom and closed at the top by a plug **41** threaded into the shaft. An O-ring **42** seals the plug into the shaft against leakage of fluid from within the shaft.

A guide pin **43** is welded to the center of the inside of the cylinder head and projects into the bore of the piston shaft with sufficient clearance to accommodate the piston return spring **44**. This spring is compressed between the piston shaft plug **41** and the cylinder head and urges the piston shaft and piston subassembly up.

The piston **38** has a number of ports **45** passing through it. These are normally closed by a ring check valve **46** having four valve stems **47** that pass through the piston. The ring valve is biased to closed position by valve springs **48** that press up on washers **49** secured to the valve stems by nuts **50**. Opposite each port **45**, the ring check valve has a small metering orifice **51**. However, fewer metering orifices may be used, and even one orifice may be enough, depending upon the resistance desired.

Upward movement of the piston is limited by a snap ring **52** in the cylinder wall.

Above the snap ring and slidable on the piston shaft and in the cylinder is an annular compensating piston **53**. Although this may be a piston without openings through it, as shown it has vertical openings **54** that are normally closed by a ring check valve **55**. This check valve a similar to the check valve **46** of the piston **38**, except that it has no metering orifices. The check valve **55** is resiliently urged to close the openings **54** by valve springs **56** that bias the valve stems **57** up.

The top of the cylinder has an annular closure member **58** held in position by snap rings **59** and **60**. The piston rod slides in a central opening **61** in the closure member which acts as a guide for the piston rod. Vents **62**, **62** extend through the closure member. These vents are tapped to receive temporary closure plugs, not shown, that are inserted prior to filling the shock absorber with hydraulic fluid. The plugs are left in place for shipment of the shock absorber and are removed when it is installed on a railroad car.

A bearing shoe **63** is fastened to the piston shaft closure plug **41** by a bolt **64**. The bolt has a shoulder **65** that is set against the spherical surface **66** of the top of the closure plug. A washer **67** is loosely fitted on the shank of the bolt. This washer has a spherical hollow **68** that mates with the spherical surface **66**, and a flat top surface **69** engaged by the flat bottom surface of the bearing shoe. Clearance is provided between the bolt head **70** and the shoe. A bolt head cover **71** is removably threaded into the bearing shoe to protect the bolt and to form a smooth bearing surface on the top of the shoe.

A cylindrical case **72** is welded to the bearing shoe and extends down around the outside of the cylinder **35**. The case is spaced from the cylinder to provide a working clearance **73** between these parts.

Operation of the shock absorber will now be explained with reference to FIGS. 5 and 6. FIG. 5 shows the shock absorber with the piston in the fully elevated position. In FIG. 6, the piston is shown in an intermediate position about half way between its top and bottom positions. With the parts disposed as shown in FIG. 5, the shock absorber is filled with hydraulic fluid such as oil to a level just above the top of the compensating piston **53**. The space between the compensating piston and the piston **38**, the openings in the pistons, and the spaces in the cylinder below the piston **38** and in the bore of the piston shaft are also filled with hydraulic fluid. The space in the cylinder above the surface of the hydraulic fluid is occupied by air.

When a downward force is applied to the shoe **63**, the piston shaft and piston **38** are forced into the cylinder. Hydraulic fluid flows from below the piston, through the metering orifices **51** in the check valve, and through the ports **45** to the zone above the piston. At the same time, the piston return spring is compressed. The metering of fluid through the orifices **51** causes substantial resistance to descent of the piston, and, smoothly dissipates most of the kinetic energy of the piston.

As the piston shaft moves down through the central opening in the compensating piston **53**, the shaft displaces

hydraulic fluid trapped between the piston and the compensating piston. The compensating piston rises in the cylinder by a distance directly related to the volume of hydraulic fluid so displaced. On the down stroke of the piston, the check valves in both the piston and the compensating piston are held closed by their respective valve springs and by the pressure of the fluid below the valves.

With the parts in the positions shown in FIG. 6, if downward pressure is released from the shoe 63, the return spring forces the piston shaft and piston up. The check valve 46 in the piston opens against the force of the valve springs 48, allowing liquid above the piston to flow freely down through the openings 45 as the piston rises. Concurrently, the compensating piston 53 falls in the cylinder, to fill the void created by withdrawal of the piston shaft through the central opening in the compensating piston.

There is no need for the check valve 55 in the compensating piston to open if the compensating piston descends freely in the cylinder. However, if the compensating piston should momentarily hang in the cylinder, or should work sluggishly, the check valve 55 would open to let hydraulic fluid from above the compensating piston flow down through the openings 54 and thereby prevent cavitation, or the drawing of a vacuum, in the fluid below the compensating piston.

There is another condition in which the check valve 55 in the compensating piston functions to prevent such cavitation. If the shock absorber remains for a long time with the piston in an intermediate position as in FIG. 6, the compensating piston may settle down in the cylinder until it comes to rest on the snap ring 52. Now, if the piston and piston shaft are suddenly depressed the compensating piston can not descend. But, the check valve 55 will open to allow fluid to flow from above the compensating piston into the space between the two pistons, thus preventing cavitation in this space. And, after a few strokes of the piston and shaft, the compensating piston will find its normal operating position.

It will be seen from the foregoing description of operation that the compensating piston prevents cavitation in the hydraulic fluid below it. It also acts as a floating or movable barrier between the main body of hydraulic fluid below the compensating piston and the air above, keeping air out of the main body of fluid and eliminating frothing. Of course, frothing in the main body of fluid would introduce compressible gas into the working fluid, and thus seriously interfere with the desired cushioning action of the shock absorber.

When four shock absorbers 29 are installed in a railroad car, as in FIGS. 1 to 3, they are subject not only to downward forces applied by the car body, but also to transverse thrust forces that are applied to the shoes 63 by the wear beams 33 as they slide over the shoes when the car body pivots on the trucks. These transverse thrust forces are adequately resisted by the shock-absorbers because of certain features of their construction. The main cylinder 35 is rigidly welded to the base 34 which, in turn is securely bolted to a truck side frame 14. The case 72 of the shock absorber overlaps the cylinder for a substantial distance and is free to move laterally with respect to the cylinder within the limits of the clearance 73 between these parts. This freedom of lateral movement is allowed by the loose fit of the shoe 63 on the shank of the bolt 64. Thus, lateral thrust forces are transmitted from the shoe through the case to the rigidly mounted cylinder, without being applied by the shoe to the bolt 64 and to the piston shaft. Any slight misalignment of the shoe with the piston shaft that may result is compensated for by the washer 67 with its loose fit on the shank of the bolt 64 and its contact with the piston shaft plug 41 through the spherical surfaces 66 and 67.

Moreover, the piston shaft and piston assembly is highly resistant to any minor transverse thrust forces that may be applied to the top of the shaft. The shaft is supported by three longitudinally spaced members namely: the piston 38, the compensating piston 53, and the annular cylinder closure member 58. These members prevent binding of the shaft and piston in the cylinder when thrust forces normally encountered in operation are applied to the piston shaft.

With reference to FIG. 4, the shock absorbers 29*a* may have the same internal construction as the shock absorbers 29 shown in FIGS. 5 to 9, and they may stand in the same direction, that is with the piston shaft extending up from the piston. In this arrangement, the fixed member 29*a* is the case, and the movable number 32*a* is the cylinder. A shoe 74 is supplied at the bottom of the cylinder and a mounting base 75 is fixed to the case.

Various modifications may be made in the specific embodiments of the invention shown and described herein without departing from the spirit of the invention as defined in the claims.

I claim:

1. A single-acting, hydraulic, shock absorbing mechanism comprising: a cylinder, a cylinder head closing one end of said cylinder, a piston slidable in said cylinder, port means extending longitudinally through said piston, check valve means for said port means, said check valve means opening toward said cylinder head, metering port means for allowing fluid to pass through said piston when said check valve means is closed, a hollow piston shaft carried by said piston and extending away from said cylinder head, an annular piston slidably mounted on said piston shaft and slidable in said cylinder, second port means extending longitudinally through the latter said annular piston, second check valve means for said second port means, said second check valve means opening toward said first-mentioned piston, and resilient means biasing said first-mentioned piston away form said cylinder head, said resilient means comprising a coil compression spring mounted within the hollow piston shaft, the spring having one end engaging an element on the piston shaft, the other end engaging said cylinder head.

2. The combination set forth in claim 1 together with piston shaft guide means supported in said cylinder and positioned remotely from said cylinder head.

3. The combination set forth in claim 1 including a spring guide pin carried by said cylinder head, said pin extending inside of said coil compression spring.

4. A single acting, hydraulic, shock absorber, comprising: a cylinder closed at its lower end and having a stop intermediate its ends, a vented guide at its upper end, a compensator piston freely movable in said cylinder between said guide and said stop, a shock absorbing piston movable in said cylinder between its lower end and said stop, a tubular stem protruding from the upper end of said cylinder and closed at its extended end, said stem being secured to said shock absorbing piston and slidable in said compensator piston and said guide, a spring within said stem and bearing against the closed end of said cylinder to extend said stem, a hydraulic liquid filling said cylinder to a level above said compensator piston, an orifice valve in said shock absorbing piston permitting restricted flow of hydraulic liquid during descent of said shock absorbing piston in said cylinder, a check valve in said shock absorbing piston permitting relatively unrestricted flow of hydraulic liquid during upward movement of said shock absorbing piston in said cylinder, a check valve in said compensator piston for relatively unrestricted downward flow of hydraulic liquid therethrough thereby to maintain the region below said compensator piston completely full of hydraulic fluid.

5. A shock absorber, as defined in claim 4, which further comprises: an inverted cylinder closed at its upper end and secured to the protruding end of said stem, said inverted cylinder slidably receiving the first mentioned cylinder, means for securing one of said cylinders in a fixed position, a slide bearing formed by the end surface of

the other cylinder, and a slide plate engageable with said slide bearing.

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Sept. 2, 1969 O. E. SEAY 3,464,366

HYDRAULICALLY DAMPENED RAILWAY TRUCK BOLSTER

Filed Sept. 29, 1966 4 Sheets-Sheet 1

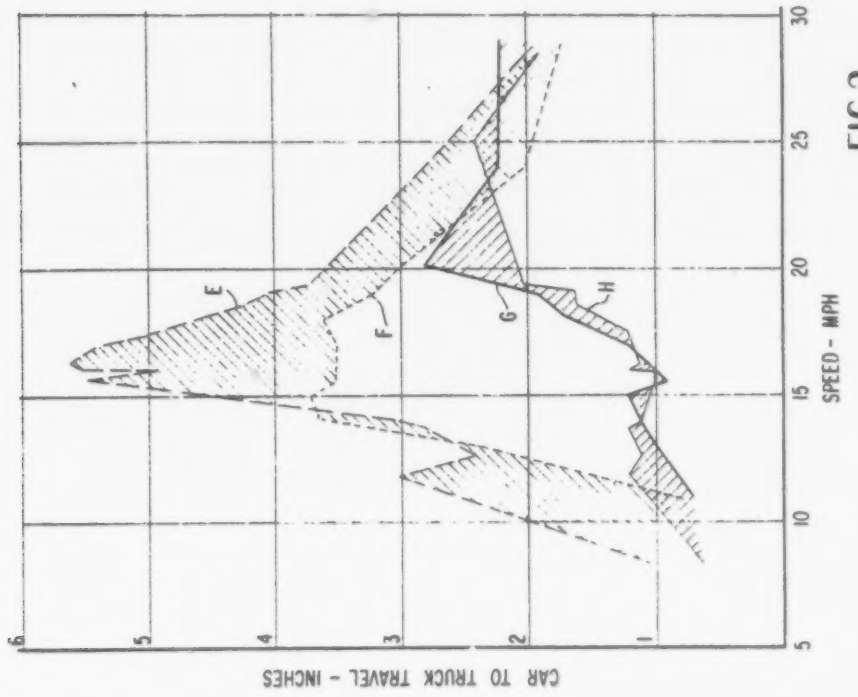

FIG 2

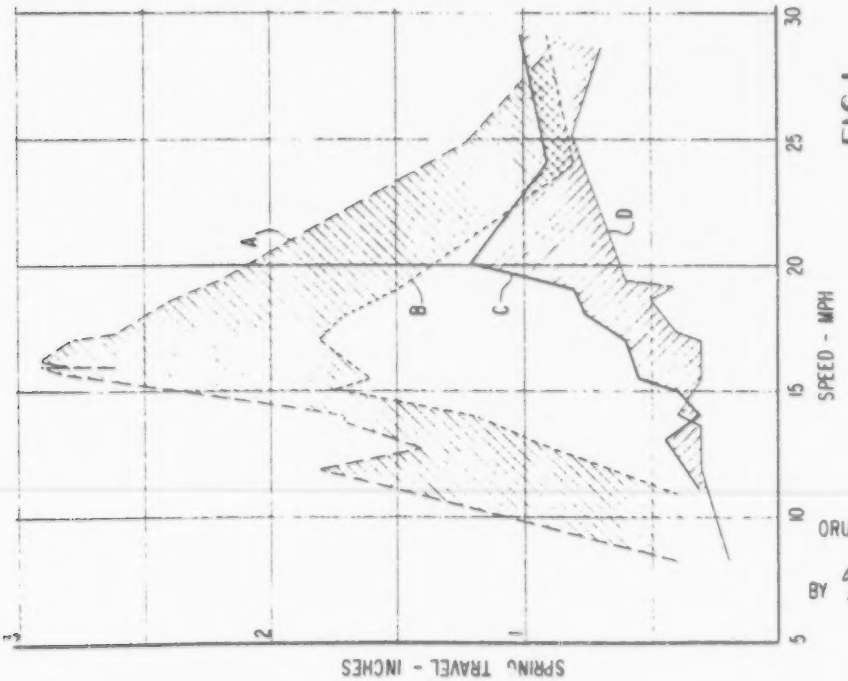

FIG 1

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PLAINTIFF'S EXHIBIT 25

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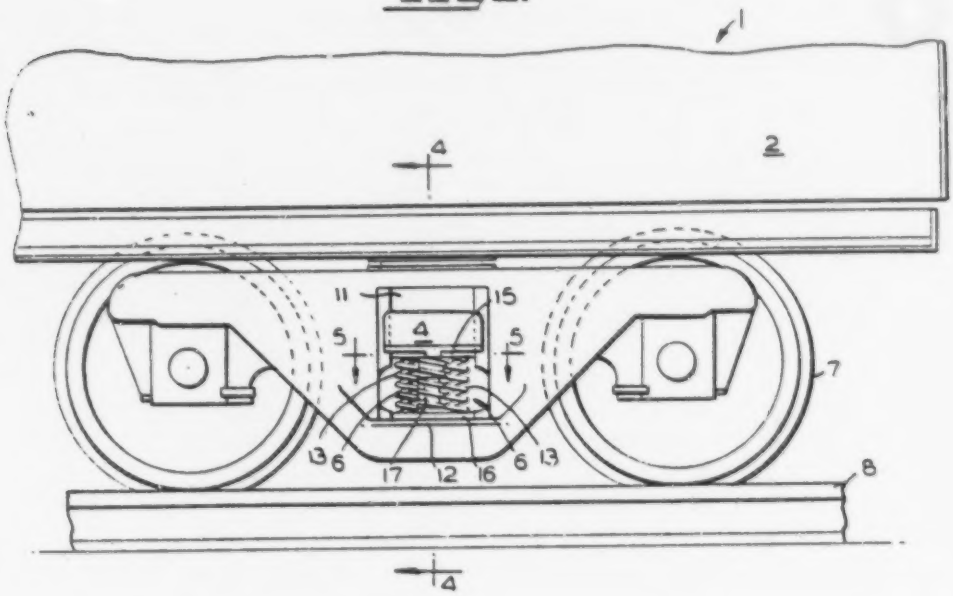
HYDRAULICALLY DAMPENED RAILWAY TRUCK BOLSTER

Filed Sept. 29, 1966 4 Sheets-Sheet 2

FIG 3.



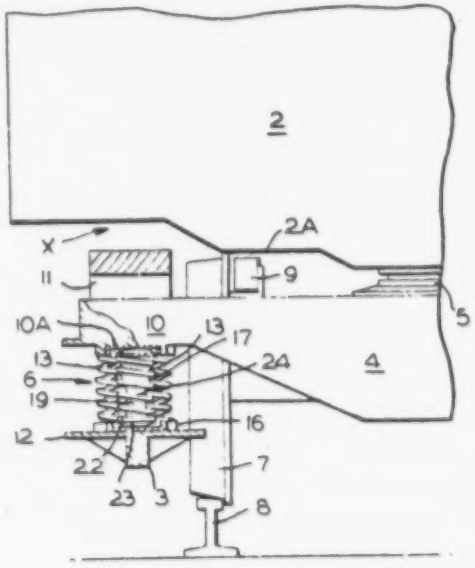
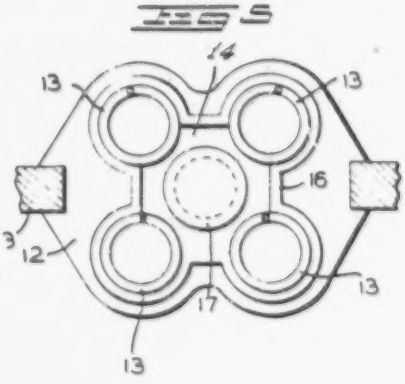


FIG 4.

FIG 5



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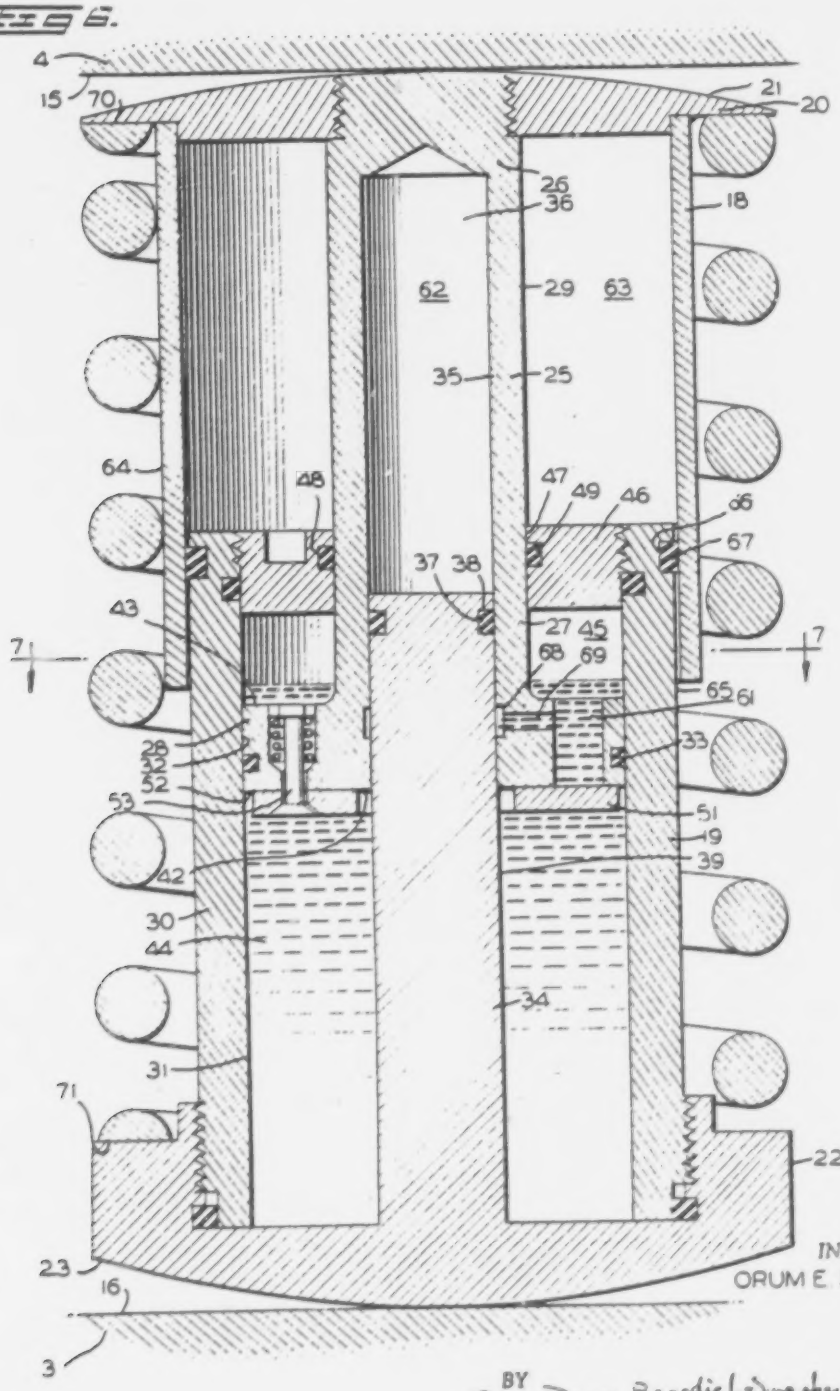
HYDRAULICALLY DAMPENED RAILWAY TRUCK BOLSTER

Filed Sept. 29, 1966 4 Sheets-Sheet 3

Fig 6.



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HYDRAULICALLY DAMPENED RAILWAY TRUCK BOLSTER

Filed Sept. 29, 1966 4 Sheets-Sheet 4

FIG 7.

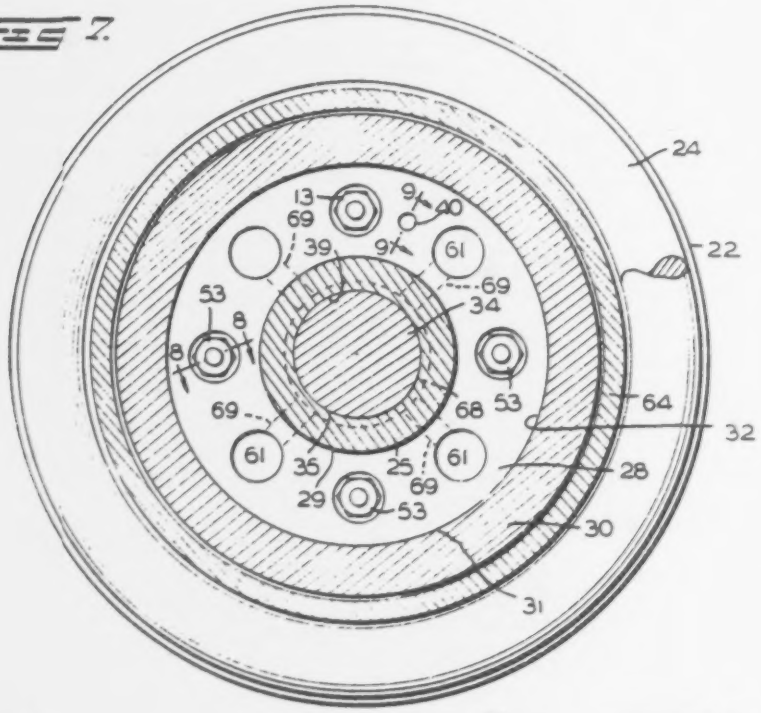


FIG 8.

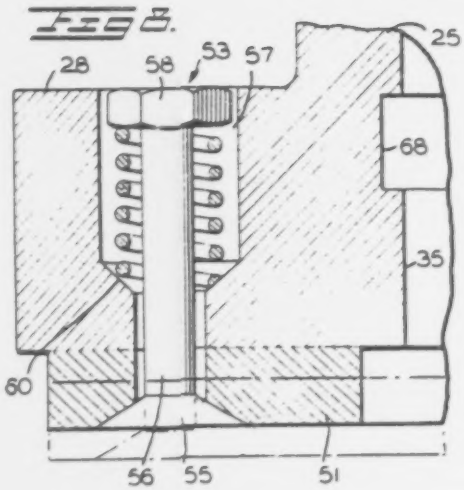
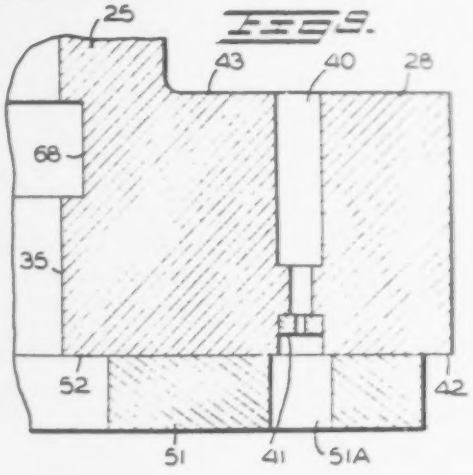


FIG 9.



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HYDRAULICALLY DAMPENED RAILWAY TRUCK BOLSTER

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U.S. Cl. 105—197 5 Claims

ABSTRACT OF THE DISCLOSURE

A shock-absorbing assembly interposed between the bolster and truck of a railway car and including a hydraulic shock-absorber freely nested between pocket defining shock-absorbing coil springs. Each end of the hydraulic shock absorber is disposed in disconnected stress-relieving engagement with either a truck or bolster portion.

General background of invention

This invention relates to a system for stabilizing railway cars against lateral sway. In particular, it relates to such a system employing a unique disposition of hydraulic shock absorbing units between the truck and bolsters of railway cars and to the novel structure of the shock absorber unit itself.

In recent years, manufacturers of railway cars have produced cars having a greater length and height than those earlier utilized. These changes in size of railway cars have tended to raise their center of gravity and increase their tendency to sway. Such sway characteristics are troublesome in that they often induce sufficient car movement to enable the wheels of a railway car to leave the track and thereby cause train derailment.

Of particular concern has been the propensity for railway cars to undergo maximum sway at the relatively low operating speeds employed in railway switching and loading yards. At such low speeds, it has been found that many railway cars, provided with conventional spring clusters between its trucks and bolsters, reach a peak of sway movement. It is generally believed that this maximum sway condition results when a railway car undergoes movement conforming to its nautral frequency of motion, as induced by the relationship between car velocity and track irregularities.

Where the peak, railway car sway condition occurs at a sustained operating speed, the sway problem becomes so pronounced as to often result in car derailment. However, where the peak sway condition occurs as a portion of the normal acceleration cycle, the period of maximum sway is transitory and far less likely to induce car derailment or serious sway conditions. However, as will be readily apparent, even where the maximum sway condition is transitory or short lived, it is desirable to minimize car movements.

To some degree excessive railway car sway which is encountered in operation is a direct consequence of the conventional structural arrangement employed to resiliently support railway cars.

In a conventional freight car suspension arrangement, each end of the car is supported by a truck and bolster assembly. The truck carries the railway car wheels while the bolster is pivotally mounted to the underside of the railway car body. Coil spring groupings at each end of the truck are interposed between the underside of the bolster and an upwardly facing portion on one side of the truck.

In this way, the railway car bolster serves as a cross beam serving to resiliently transfer the weight of the railway car to the railway car truck. However, the conventional pivot connection between the railway car and its bolster is such as to allow some limited pivotable movement of the car relative to the bolster. Thus the car body can undergo some limited swaying movement which is not controlled by the springs supporting the bolster. Thus excessive spring movement will often tend to induce free movement of the railway car body relative to the bolster which is not adequately controlled by the bolster springs and which may be of a sufficient amplitude to induce derailment.

Of additional concern is the normal lateral freedom of movement of a bolster relative to its associated truck. Although limited in extent, this movement is sufficient to impose severe lateral force on the suspension system.

A variety of hydraulic shock absorbing systems have been proposed for utilization in railway car stabilizing systems in an effort to minimize car movements. However, these shock absorbing arrangements have required special mounting connections so as to complicate their installation in present railway equipment.

It also must not be overlooked that a basic problem involved in stabilizing railway cars entails the severity of forces and dynamic loading variations which are imposed on their suspension components. Obviously a railway car carrying a load on the order of a hundred tons generates forces which are exceedingly difficult to accommodate. For this reason, shock asborbing devices for use in railway cars must be characterized by unusual structural ruggedness.

Objects and summary of invention

Particularly with respect to the new railway cars which are vulnerable to excessive sway phenomena it is an object of the present invention to provide a railway car movement stabilizing system and shock absorbing device which substantially reduce the degree of car sway and reduce or eliminate car derailment tendencies.

It is a further object of the invention to provide such an improved stabilizing system and device which reduce the extent of axially oscillating movement of railway car springs so as to reduce the amplitude of railway car body movement relative to the trucks of the railway car, i.e., relative to the track on which the car is traveling.

It is also an object of the invention to increase the speed at which maximum railway car sway conditions occur in response to track conditions to a speed above that normally employed in switching and loading yards.

It is also an object of the invention to provide a railway car shock absorber arrangement disposed between the bolster and truck of a railway car and which does not require special mounting arrangements to accommodate rotary movement of the truck relative to the car.

It is a related object of the invention to provide a shock absorber disposed between a railway car truck and bolster which is disconnected with either of these car components.

A further object of the invention is to provide an improved mounting arrangement for a railway car shock absorber wherein the problems associated with lateral car body movement relative to the shock absorber are minimized.

Yet another object of the invention is to provide a railway car shock absorbing structure which is continuously in precompressed engagement with railway car truck and bolster portions and which is nested within the conventional coil spring bolster mounting arrangement.

It is also an object of the invention to provide an improved railway car, hydraulic shock absorber including an arrangement for effectively stabilizing the movement of a piston of the shock absorber within an associated cylinder.

Yet another object of the invention is to provide an improved railway car, hydraulic shock absorber including air compression chambers which aid in restoring the piston and cylinder components to their normal positions, after they have been converged.

It is also an object of the invention to provide such an improved railway car shock absorbing structure including a unique passage arrangement which serves to prevent hydraulic fluid from being transferred into air compression chambers of the shock absorber body.

In order to accomplish some of the principal objects heretofore noted, there is presented through this invention a basic railway car stabilizing system comprising shock absorbing means having mutually and yieldably convergeable ends. Means provide rolling and sliding contact between one end of this shock absorbing means and one portion of a railway car while other means provide rolling and sliding contact between the other end of the shock absorbing means and another portion of the railway car.

A particularly advantageous embodiment of the invention involves this basic system wherein the shock absorbing means is disposed in a pocket defined by a plurality of axially displaced, coil spring units.

Another particularly advantageous embodiment of the invention involves the basic system including precompressed resilient means which maintain the shock absorbing means in continuous, resiliently biased, compressive engagement with relatively movable portions of the railway car suspension system.

Optimum system advantages are derived where the shock absorbing means is nested between spaced coil springs and disposed in precompressed, resiliently biasing engagement with railway car portions, with opposite ends of the shock absorbing means each being in rolling and sliding engagement with a railway car portion. In this optimum embodiment of the invention, the shock absorbing means is preferably disposed in engagement with an under portion of an end of a railway car bolster and an upwardly facing portion of a railway car truck, with such a shock absorbing mounting arrangement being provided between each end of each bolster of the railway car and its associated truck portion.

A further and independently significant facet of the invention pertains to a shock absorbing structure which is characterized by a piston stabilizing pin which projects longitudinally of piston means. A longitudinally extending, stabilizing passage is formed in the piston means and telescopingly receives the stabilizing pin. In this combination, the stabilizing pin is disposed in slidable and stabilizing engagement with the stabilizing passage continuously throughout the movement of the piston means.

In a preferred and particularly advantageous form of this shock absorber structure, passage means are carried by the piston means which provide fluid communication between the low pressure end of the piston means and the interface between the stabilizing passage and the stabilizing pin.

Uniquely important advantages are derived from the basic structure of the improved shock absorber when it includes a first wall defining a spherical segment facing outwardly of the shock absorber and a second wall defining a spherical segment facing outwardly of the shock absorber and a second wall defining a spherical segment facing outwardly of the shock absorber and away from the first wall.

Drawings

In describing the invention reference will be made to a preferred embodiment as illustrated in the appended drawings.

In the drawings:

FIGURE 1 graphically illustrates performance curves comparing the maximum spring travel characteristics of a conventional railway car suspension system and the improved suspension system of the present invention;

FIGURE 2 graphically illustrates performance curves comparing the degree of maximum, railway car body to truck, movement for standard railway cars and railway cars including the improved stabilizing system of the present invention;

FIGURE 3 is a fragmentary, schematic view of an end of a railway car illustrating structural relations between a shock absorber, coil springs, railway car truck, and railway car bolster as disposed in accordance with the invention;

FIGURE 4 provides a fragmentary transverse sectional view through the shock absorbing arrangement of the FIGURE 3 stabilizing system;

FIGURE 5 is a fragmentary sectional view of the FIGURE 3 assembly, looking downwardly on the hydraulic shock absorber and its nesting pocket as defined by a plurality of axially displaced, coil springs;

FIGURE 6 is an enlarged, sectioned elevational view of the shock absorber employed in the FIGURE 3 assembly;

FIGURE 7 is a transverse sectional view of the FIGURE 6 shock absorber as viewed along the section lines 7—7 of FIGURE 6;

FIGURE 8 is an enlarged sectional view of a check valve portion of the FIGURE 6 shock absorber as viewed along the section line 8—8 of FIGURE 7; and

FIGURE 9 is an enlarged sectional view of a restricted passage defining metering orifice included in the piston component of the FIGURE 6 assembly, as viewed along the section line 9—9 of FIGURE 7.

Overall stabilizing system

FIGURES 3, 4 and 5 illustrate a typical freight car 1 which has been modified to include the stabilizing system of the present invention.

Railway car 1, in a conventional fashion, includes a car body 2, a railway truck 3, a bolster 4, a pivot bearing 5, and spring and shock absorbing suspension means 6.

Truck 3 is conventional and supports four wheels 7. On each side of the truck two wheels are aligned in engagement with a rail 8 as shown in FIGURE 3. Bolster 4 is connected by the pivot bearing 5 to the underside of railway car 1. Pivot bearing 5, consistent with the usual degree of tolerances employed in fabricating railway cars, enables car body 2 to undergo limited swaying or pivoting movement transversely of the longitudinal median plane of the car. Thus, bolster 4, on each end of its top side, may carry a roller bearing 9 which may be spaced slightly beneath the underside of the car body 1. When the car body 2 rocks or sways laterally on the pivot bearing 5 relative to the bolster 4, its underside portion 2A will engage one of the roller bearings 9 so as to limit this rocking movement. The roller bearings 9 on each side of the bolster 4 serve to facilitate rotational movement of the bolster 4 about the generally vertical pivot axis of pivot bearing 5.

Bolster 4, at each end 10, is mounted for generally vertically guided, sliding movement in a truck aperture 11. Between the underside 10A of each end 10 of the bolster 4 and an upwardly facing base 12 at the lower end of the truck recess 11 is interposed the coil spring and hydraulic shock absorber assembly 6. As will be understood, this assembly is interposed between each end of each bolster of the railway car and its associated truck portion. Thus the car 1 is provided with four such assemblies 6, two carried by a truck at one end of the car and two carried by the truck at the other car end.

Each assembly 6 may comprise four coil springs 13 mounted in generally horizontal alignment with their axes being mutually parallel and parallel to the pivot axis of the pivot bearing 5. These four coil springs 13 have their longitudinal axes horizontally displaced so as to define a central pocket 14. Coil springs 13 may be mounted between upper and lower plates 15 and 16 in a conventional fashion in a manner generally consistent

with the coil spring and mounting plate arrangement featured on page 879 of the 1966 Car and Locomotive Cyclopedia, published by Simmons-Boardman Publishing Corporation of New York. As will be understood, many conventional suspension units employ more than four coil springs.

With this mounting arrangement, the lower plate 16, in essence, functions as an upwardly facing, planar wall portion of the truck 3, while upper plate 15 functions as a downwardly facing planar wall portion of the bolster 4. The manner in which the coil springs 13 and their associated mounting plates 15 and 16 are secured between the truck aperture base 12 and bolster end 10 is conventional in character and is illustrated, for example, on page 882 of the 1966 Car and Locomotive Cyclopedia.

As will be appreciated, the coil springs 13 may be installed without the associated mounting plates so as to directly engage the underside 10A of the bolster 10 and the base 12 of the truck recess 11 in the manner generally illustrated on page 818 of the 1966 Car and Locomotive Cyclopedia.

Mounted in the pocket 14, which is more or less peripherally defined by the coil springs 13, is a hydraulic, shock absorbing device 17. The hydraulic shock absorbing device includes an upper disposed, piston portion 18 which is telescopingly received within a lower disposed, cylinder portion 19. Piston and cylinder portions 18 and 19 are mounted in the pocket 14 with their axes of telescoping movement extending generally vertically, i.e., generally longitudinally of the pocket 14. The piston portion 18 carries an upper end wall 20. End wall 20 has an upwardly and axially facing face 21 in the form of a spherical segment disposed in rolling and tangential sliding engagement with the planar wall portion 15 of the truck 4. Cylinder 19 carries a lower end wall 22 of the shock absorber 17. End wall 22 includes a downwardly and axially facing spherical segment face 23 which is disposed in rolling and tangential sliding engagement with the upwardly facing planar wall portion 16 of the truck 3.

Preferably, the width, i.e., diameter, of each unit 17 corresponds substantially to the width or diameter of the coil springs 13. This facilitates the fabrication of an assembly 6 by merely replacing the center or fifth spring of a five-spring shock absorbing unit, as shown on page 879 of the 1966 Car and Locomotive Cyclopedia, with the shock absorber 17 of the present invention.

The width of the horizontal spaces between adjacent coil springs 13 is less than the width of the shock absorber 17. Thus the shock absorber 17 is prevented by the coil springs from moving laterally out of the pocket 14. As will be appreciated, the pocket 14, in order to restrain the hydraulic shock absorber 17 against lateral movement, requires a plurality of at least three, pocket periphery defining, coil springs 13. However, it should be here noted that the invention may be practiced with a shock absorber unit 17 being used to replace any of the springs 13. Where the unit 17 replaces an outside spring 13, it will be retained in place by conventional spring retaining structures such as the flanges of mounting plates illustrated on page 879 of the 1966 Car and Locomotive Cyclopedia.

The shock absorber 17 is disconnected with either the bolster 4 or the truck 3, being disposed only in rolling and tangential sliding engagement with these car components. A coaxial and peripherally disposed, precompressed coil spring 24 serves to bias the spherical segments 21 and 23 into resiliently compressive engagement with the wall portions 15 and 16 respectively. Thus, as illustrated, coil spring 24 urges the shock absorber end walls 20 and 22 mutually outwardly and maintains these end walls in mutually and yieldably convergeable relation.

In this fashion, each of the four shock absorbers 17 associated with the car 1 exerts a resilient lifting force against the underside of each end of each of the two bolsters 4 associated with the car 1. When a bolster 4 undergoes lateral movement relative to the truck 3, as permitted by the conventional loose, sliding mounting of the bolster end 10 in the truck recess 11, minimized horizontal thrust is imposed on the shock absorber 17 owing to the rolling and tangential, sliding contact between the upper and lower ends of the shock absorber 17 and the bolster and truck respectively. The generally point-like contact between the spherical segments enables stress relieving sliding movement to occur between the segments and the planar wall portions which they contact. The rolling contact between the segments and planar wall portions enables each shock absorber to pivot in response to the imposition of laterally directed force. This pivoting prevents the piston of the shock absorber from being jammed laterally against its cylinder so as to impede its downward movement. Excessive pivoting and/or sliding of each shock absorber 17 is prevented by the restraining influence of the inner, pocket defining, portions of the coil springs 13.

Structure and operation of shock absorber

FIGURES 6 through 9 illustrate structural details of the shock absorber 17.

As previously noted, shock absorber 17 comprises a piston component 18 and a cylinder component 19.

Piston component 18 includes a generally tubular piston rod 25 having a closed upper end 26, an open lower end 27 and an annular piston head 28. Piston rod 26 is cylindrical in character so as to have a cylindrical outer surface 29.

Cylinder 19 includes a cylindrical wall 30 providing an inner wall 31 having a circular cross-section which slidably and sealing engages the outer circularly and matingly cross-sectioned periphery 32 of the annular piston 28. Annular piston 28 may carry an elastomeric or metallic piston ring 33 to positively insure slidable and sealing engagement between the piston periphery 32 and the cylinder wall 31.

Cylinder 19 has a closed lower end defined by lower end wall 22 of the shock absorber 17. As illustrated in FIGURE 6, end wall 22 may be threadably connected to cylindrical wall 30 of cylinder 19 so as to provide the closed lower end of the cylinder. As previously noted, lower end wall 22 includes a spherical segment surface 23 having a radius which is coaxial with the central axis of the cylinder wall 30 of the cylinder 19 and the piston 18.

A stabilizing pin 34 of generally uniform circular cross-section projects axially upwardly from the end wall 22 toward the piston 18.

Piston rod 25 includes an inner surface 35 having a generally axially uniform, circular, cross-sectional configuration. Surface 35 defines a central, coaxial, and longitudinally extending passage 36 having an open lower end and a closed upper end.

Passage 36 continuously, telescopingly and slidably receives the upwardly projecting pin 34. Sealing and slidable engagement between pin 34 and the passage 36 may be promoted by an annular gasket 37 carried in an annular recess 38 on the upper end of the pin 34. Wall 35 of passage 36 is disposed in slidable, mating engagement with the outer periphery 39 of the pin 34 so as to positively stabilize the piston head 28 for axially centered, sliding movement within the cylinder 19. Thus, skewing of the piston 18 relative to the cylinder 19 is effectively prevented at all times.

Piston head 28 includes at least one longitudinally extending flow impeding or flow restricting passage 40. A replaceable flow metering orifice 41 may be press-fitted or threaded into the passage 40 as generally shown in FIGURE 9. Passage 40 provides fluid communication between the high pressure end 42 of the piston head 28 and the low pressure end 43 of this piston. As shown in FIGURE 6, high pressure end 42 is disposed in engage-

ment with and faces a body 44 of hydraulic fluid such as oil, while low pressure end 43 faces an at least partially unoccupied cavity 45 designed to receive fluid which passes through the restricted passage 40 from the fluid body 44.

The upper end of cavity 45 may be closed by an annular rim 46 projecting radially inwardly from the upper end of the wall 30. As shown in FIGURE 6, rim 46 may be threadably secured to the wall 30 and includes a central, generally cylindrical, aperture defining surface 47 disposed in slidable and sealing engagement with the outer periphery 39 of the piston rod 25. Cylindrical surface 47 may include an annular recess 48 in which is inserted a conventional annular gasket 49 to promote slidable and sealing engagement between the rim 46 and the piston rod 25.

As will be appreciated, the passage 40 is designed to impede converging movement of the piston head 28 into the cylinder 19, i.e., downward movement of the piston head 28 as shown in FIGURE 6. This impeded movement serves to absorb compressive energy imposed on the upper end of the piston 18 by movement of the railway car body and its associated bolster 4.

Rapid return or upward movement of the piston head 28 is facilitated by check valve means 50 carried by the piston head 28.

Check valve means 50 comprises an annular valving plate 51 supported on the under or high pressure end of the piston 28. Valving plate 51 is biased upwardly into mating engagement with a radially extending valve seat 52 by a plurality of spring mechanisms 53.

Each spring mechanism 53, as shown in FIGURE 8, includes a bolt-like member 54 having a lower head 55 secured to the plate 51 and a shank 56 which passes upwardly through a piston head passage 57 to terminate in an enlarged upper end 58. Upper end 58 may be defined by a conventional nut threadably secured to the shank 56. A coil spring 59 encircles the shank 56 and at its upper end, engages the underside of the nut 58 and at its lower end, an annular seat 60 formed in the passage 57.

One or more check valving passages 61, as shown in FIGURES 6 and 7, extend longitudinally of and through the piston head 28 so as to provide fluid communication between the high and low pressure ends of the piston head. When valve plate 51 is in its upwardly spring-biased position shown in FIGURE 6, closing the lower end of the passages 61, an upward flow of fluid from the body 44 through the passages 61 is prevented or at least effectively minimized. Thus, on the downward stroke of the piston head 28, fluid flow is governed by the flow restricting orifice 41. As shown in FIGURE 9, plate 51 includes an aperture 51A providing continuous fluid communication between passage 40 and fluid body 44.

On the upward or return stroke of the piston head 28, fluid which has been transferred into the cavity 45 may return rapidly to the passage 44 by flowing downwardly through the passages 61 and moving the plate 51 out of valving engagement with the radial face 52 by overcoming the biasing effect of the coil springs 53. This, of course, enables the piston head 28 to restore itself in a rapid fashion.

The restoring of the piston head 28 is also facilitated by a pair of coaxial air compression chambers formed as unitary components of the shock absorber 17.

One such air compression chamber 62 is defined by the piston rod 25 and the stabilizing pin 34. Thus, compression chamber 62 comprises the upper end of the stabilizing pin receiving passage or stabilizing passage 36 defined by the interior of the piston rod 25. On the downward or compression stroke of the piston 18, air within the chamber 62 is compressed and the energy of this compressed air facilitates the restoration of the piston to its upper level.

The other air compression chamber of the apparatus comprises an annular chamber 63 which encircles the piston rod 25 and is disposed axially between the cylinder rim wall 46 and the spherical segment defining, end wall 20.

As illustrated, wall 20 may be threadably connected to the upper end of the stem 25. A cylindrical shroud 64 is carried by the wall 20 and projects axially downwardly into slidable and sealing engagement with the outer cylindrical periphery 65 of the cylinder 19. Cylinder 19, on its outer periphery and in an annular groove 66, may carry an annular gasket 67 to promote sealing and sliding engagement between the shroud 64 and the cylinder periphery 65. Thus, on the compression or downward stroke of the piston 18, air within the compression chamber 63 is compressed and the energy of this compressed air also serves to facilitate the restoration of the piston 18 to its uppermost location.

As will be appreciated, it is undesirable that fluid within the hydraulic body 44 migrate into the air chambers 62 or 63. The likelihood of such migration occurring is most acute with respect to the central air chamber 62.

To avoid the likelihood of migration of hydraulic fluid into the chamber 62 occurring, a unique high pressure fluid, scavenging system is incorporated between the piston stabilizing pin 34 and the piston head 28. This scavenging system comprises an annular and radially outwardly extending recess 68 formed in the surface 35 radially adjacent the piston head 28. A passage 69 extends radially from each of the check valve passages 61 to the annular recess 68. The annular recess 68 and the radial passages 69 provide fluid communication between the lower pressure chamber 45, and the interface between the piston head 28 into stabilizing pin 34. Thus, fluid from the high pressure hydraulic body 44 which migrates between the mating faces of the piston head 28 and the stabilizing pin 34 will be transferred through the recess 68 and passages 69 and 61 to the low pressure oil chamber 45, rather than to the air chamber 62.

As previously described, and as illustrated in greater detail in FIGURE 6, the lower annular surface 70 of the wall 20 outside of the shroud 64 and the upper annular surface 71 of the end wall 22 outside of the cylinder wall 19 are engaged by upper and lower ends respectively of a coil spring 24. Coil spring 24 tends to restore the piston 18 to its upper position shown in FIGURE 6 after the piston component 18 has been converged with the cylinder component 19, i.e., moved downwardly.

The shock absorbing assembly 17 is installed with the spring 24 compressed, i.e., the wall means 15 of the bolster 4 depresses the upper end 21 of the piston component 18 sufficiently to precompress the spring 24 so that the spherical segment surfaces 21 and 23 are maintained in precompressed, tangential engagement with the wall portions 15 and 16 respectively.

The rolling and sliding engagement between each end of the shock absorber 17 and a portion of the railway car, coupled with the continuously pin stabilized piston, assures a uniquely effective operation of the shock absorber 17.

Lateral thrust forces imposed by the railway car body 2, through the bolster 4, to the shock absorber 17, induce rolling movement of the shock absorber 17, rather than tending to skew or twist the piston head 28 within the cylinder wall 30. Any such skewing tendency as might be present is effectively offset by the piston movement stabilizing pin 34. Rapid restoration of the shock absorber, subsequent to a compression stroke, is facilitated by the coil spring 24 operating in conjunction with the air compression chambers 62 and 63.

The continuously effective character of the air compression chamber 62 is assured by the scavenging system defined by the recess 68 and the passage means 69 and 61. This scavenging system, of course, also prevents undesired loss of hydraulic fluid or oil from the main oil body 44.

The continuously effective compressive engagement of each of the four shock absorbers 17 with a bolster portion of the railway car 1 insures that movement of each end of each bolster of the railway car is continuously dampened without interfering with pivotable movement of the bolster 4 about its pivot mount 5.

Improvement in railway car stabilization obtained through the invention

FIGURES 1 and 2 graphically compare railway car stabilization as achieved by conventional spring suspension systems and as achieved with a hydraulic shock absorber structure and shock absorber disposition in accordance with the present invention.

Curves A and B of FIGURE 1 depict the maximum changes in axial length of the coil springs 13 that occur in standard railway cars lacking the shock absorber structure and shock absorber mounting of the present invention.

These tests were performed on curved track sections with curve A depicting maximum movement of the coil springs located on the ends of bolsters disposed on the outside of the curved track. Curve B depicts the maximum movement of coil springs in engagement with bolsters on the inside track of the curve.

Curves C and D depict the maximum extent of axially oscillating movement of coil springs when the car suspension system has been modified by the incorporation of the shock absorber structure and mounting arrangement previously described. Curve C graphically illustrates maximum changes in axial dimension of coil springs in engagement with bolsters on the outer rail side of the track. Curve D depicts maximum axial spring movement for springs engaging bolsters on the inner rail side of the curve.

As will be apparent by reference to the curves of FIGURE 1, with a conventional suspension system, maximum spring travel during the test was measured to be of the order of about 2.9 inches. Where the suspension system was modified by the addition of the shock absorber assembly previously described, this spring travel was reduced to about 1.2 inches.

FIGURE 2 graphically illustrates comparisons of the maximum relative movement which occurs between a railway car body and one of its associated trucks with respect to standard railway car suspension systems and suspension systems modified by the incorporation of shock absorber arrangement of this invention.

Curves E and F of FIGURE 2 were derived from the operation of railway cars having standard suspension systems and illustrate maximum relative movement between car bodies and car trucks. This movement is the general degree of relative movement between car body and car truck which occurs in the area X of FIGURE 4. Curve E depicts this movement which occurs on the railway car on the outer rail side of a track, while curve F depicts the movement which occurs on the inner rail side of a track.

Curves G and H depict the degree of maximum movement of a railway car body relative to a railway car truck where the car has been provided with the shock absorber structure and mounting arrangement of this invention. Curve G depicts maximum car to truck movement on the outer rail side of a curved track, while curve H depicts maximum car to truck movement on the inner side of a rail track.

As FIGURE 2 illustrates, with a conventional car suspension system, maximum car to truck movement, i.e., lateral sway, was on the order of 5.6 inches. Where the suspension system was modified by the structure and mounting arrangement of the shock absorber assemblies of the present invention, this sway movement was reduced in half, i.e., to about 2.8 inches.

This reduction in sway of car movement significantly minimizes the chances of car derailment. Indeed, during the test which produced the results reflected in the charts of FIGURES 1 and 2, wheel lifting on cars provided with the shock absorber system of this invention was not observed. However, wheel lifting with the standard car suspension systems was observed at several points.

It is also significant to note that with cars modified by the addition of the shock absorbing system of the present invention, the speed at which maximum sway occurs was raised from about sixteen miles per hour to about twenty miles per hour. This shift of the critical sway speed is significant in that most railway cars operate in railway yards at speeds often in the vicinity of fifteen or sixteen miles per hour. Thus, in shifting the critical sway speed to a higher level above the speed normally encountered in yard operations, the likelihood of derailments in railway yards has been substantially reduced. As has been previously noted, the occurrence of maximum sway tendencies at a higher speed, which cars attain during acceleration on open track, is not nearly as serious from the standpoint of inducing derailment.

It should also be noted that the suspension system of this invention reduces substantially the divergence between peak spring travel for springs at the inner and outer bolster ends. This is shown in FIGURE 1 by comparing the thickness of the two shaded zones at the peak sway points. Similarly, by referring to FIGURE 2, it will be seen that the improved suspension system reduces the divergence between peak car body movement, relative to a truck, as measured at the inner and outer rail car body sides.

Other comparative tests conducted with the standard cars and cars provided with the stabilizer systems of this invention have produced data indicating that this stabilizing system will effect sway reductions up to 69%, with average sway reductions often being measured on the order of 60%. Even with cars which did not normally tend to undergo heavy sway, the incorporation of the stabilizer system of this invention tended to reduce sway on the order of 28%.

In describing the invention reference has been made to a preferred shock absorber structure and installation embodiments. However, those skilled in the railway art and familiar with the disclosure of the invention may well recognize additions, deletions, substitutions or other modifications which would fall within the purview of the invention as defined in the appended claims.

I claim:

1. A railway car stabilizing device comprising:

at least three coil spring means having mutually displaced longitudinal axes, said axes being spaced about a shock absorber receiving pocket;

shock absorber means disposed in said pocket;

a downwardly facing wall portion carried by a bolster of a railway car;

an upwardly facing wall portion carried by a truck of said railway car associated with said bolster;

said shock absorber means being disposed in said pocket in abutting engagement with said downwardly and said upwardly facing wall portions and being restrained from lateral movement out of said pocket by said plurality of coil springs, with each adjacent pair of said plurality of springs being spaced a distance less than the width of said shock absorber means;

said shock absorber means comprising an assembly including piston means disposed in slidable stress relieving engagement with one of said bolster and truck wall portions;

said assembly further including cylinder means telescopingly receiving said piston means for hydraulically impeded movement in response to convergence of said wall portions of said truck and bolster, with said cylinder means being disposed in slidable stress relieving engagement with the other of said bolster and truck wall portions; and

said bolster wall portion being retractably convergible with said truck wall portion and operable, in response to convergence with said truck wall portion, to telescopingly contract said shock absorber means; and

said coil spring means being operable to urge said bolster wall portion, when converged with said truck wall portion, away from said truck wall portion and permit said shock absorber means to telescopingly extend.

2. A railway car stabilizing device comprising:

cylinder means;

piston means telescopingly received within said cylinder means;

restricted passage means in said piston means providing fluid communications between each of opposite axial ends of said piston means;

said piston means having a high pressure end in engagement with a body of fluid and a low pressure end facing a cavity intended to receive fluid which passes from the high pressure end of said piston means through said restricted passage means;

a piston stabilizing pin projecting longitudinally of said piston means;

a longitudinally extending stabilizing passage formed in said piston means and telescopingly receiving said stabilizing pin;

said stabilizing pin being disposed in slidable and stabilizing engagement with said stabilzing passage continuously throughout the movement of said piston means;

mutually and yieldably convergible ends carried by said cylinder means and said piston means;

means providing rolling and sliding contact between one of said ends and a bolster portion of a railway car; and

means providing rolling and sliding contact between the other of said ends and a truck portion of said railway car; and

a plurality of spaced spring units disposed externally of and peripherally confining said telescopingly assembled cylinder means and piston means, with said plurality of spring units extending between and engaging said bolster and truck portions;

said bolster portion being retractably convergible with said truck portion and operable, in response to convergence with said truck portion, to telescopingly contract said cylinder means and piston means; and

said spring units being operable to urge said bolster portion, when converged with said truck portion, away from said truck portion and permit said cylinder means and piston means to telescopingly extend.

3. A railway car stabilizing device comprising:

a cylinder;

a piston telescopingly received within said cylinder;

restricted passage means in said piston providing fluid communications between each of opposite axial ends of said piston;

a piston stabilizing pin having an axially uniform circular cross-section projecting longitudinally of said piston;

a longitudinally extending stabilizing passage having a circular cross-section formed in said piston. and having a closed end and an open end telescopingly receiving said stabilizing pin;

said stabilizing pin being disposed in slidable and stabilizing engagement with said piston continuously throughout the movement of said piston;

a first end wall connected with said piston and defining a spherical segment facing axially outwardly of said piston;

a second end wall connected with said cylinder and defining a spherical segment facing axially outwardly of said cylinder and away from said first end wall; the spherical segments of said first and second end walls having axially aligned radii which are axially aligned with the central axis of said piston;

a first, sealed, air cushioning chamber defined by said stabilizer pin and said closed end of said stabilizing passage;

a cylinder shroud carried by said piston disposed in sealing and telescoping engagement with the outer periphery of said cylinder and defining a second sealed, air cushioning chamber axially adjacent one end of said cylinder;

a coil spring extending coaxially about said shroud and said cylinder, said spring being in abutting engagement with said upper and lower end walls;

at least one check valve carried by said piston and openable to permit fluid flow from said low pressure end of said piston to the high pressure end thereof;

at least three coil spring units having mutually displaced longitudinal axes, said coil spring units being spaced about and defining a pocket;

a downwardly facing planar, wall portion carried by a bolster of a railway car; and

an upwardly facing, planar wall portion carried by a truck of said railway car associated with said bolster;

said cylinder and piston being disposed in said pocket in abutting engagement with said downwardly and said upwardly facing wall portions and being restrained from lateral movement out of said pocket by said plurality of coil springs, with each adjacent pair of said plurality of springs being spaced a distance less than the width of said assembled piston and cylinder;

said spherical segment of said first end wall providing rolling and sliding contact between said piston means and said planar wall portion of said bolster; and

said spherical segment of said second end wall providing rolling and sliding contact between said cylinder and said planar wall portion of said truck;

each of said planar wall portions being disposed in tangential contact with its respectively associated spherical segment;

a plurality of spaced spring units disposed externally of and peripherally confining said telescopingly assembled cylinder and piston, with said plurality of spring units extending between and engaging said planar wall portions of said bolster and truck;

said bolster wall portion being retractably convergible with said truck wall portion and operable, in response to convergence with said truck wall portion, to telescopingly contract said cylinder and piston;

said spring units being operable to urge said bolster wall portion, when converged with said truck wall portion, away from said truck wall portion and permit said cylinder and piston to telescopingly extend.

4. A railway car stabilizing device comprising:

shock absorbing means having mutually and yieldably convergible ends;

means providing rolling and sliding contact between one end of said shock absorbing means and a bolster portion of a railway car;

means providing rolling and sliding contact between the other end of said shock absorbing means and a truck portion of said railway car;

precompressed resilient means maintaining said shock absorbing means in continuous, resiliently biasing, engagement with each of said portions of said railway car; and

a plurality of spaced spring units disposed externally of and peripherally confining said shock absorbing means and extending between and engaging said bolster portion and truck portion;

said shock-absorbing means comprising piston means connected with one of said mutually convergible ends and cylinder means connected with another

of said mutually convergible ends, with said cylinder means telescopingly receiving said piston means;

said bolster portion being retractably convergible with said truck portion and operable, in response to convergence with said truck portion, to telescopingly contract said shock absorber means; and

said spring units being operable to urge said bolster portion, when converged with said truck portion, away from said truck portion, and permit said shock absorber means to telescopingly extend.

5. A railway car stabilizing system having apparatus between each end of each bolster of said car and an underlying portion associated therewith, said apparatus comprising:

cylinder means;

piston means telescopingly received within said cylinder means;

restricted passage means providing fluid communications between each of opposite axial ends of said piston means;

said piston means having a high pressure end in engagement with a body of fluid and a low pressure end facing a cavity intended to receive fluid which passes from the high pressure end of said piston means through said restricted passage means;

at least three coil spring units having mutually displaced longitudinal axes, said coil spring units being spaced about and defining a pocket;

said cylinder means and piston means being disposed in said pocket, externally of said spring units;

said piston means having an upwardly facing end wall;

said cylinder means having a downwardly facing end wall;

means providing rolling and sliding contact between said upper end wall and an under portion of a bolster of a railway car;

means providing rolling and sliding contact between said lower end wall and a truck portion of said railway car associated with said bolster; and

pre-compressed resilient means between and engaging said upper and lower end walls and maintaining said walls in compressive, elastically yieldable engagement with said bolster portion and truck portion;

said bolster portion being retractably convergible with said truck portion and operable, in response to convergence with said truck portion, to telescopingly contract said cylinder means and piston means; and

said spring units being operable to urge said bolster portion when converged with said truck portion, away from said truck portion, and telescopingly extend said cylinder means and piston means.

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No. 83-1839

In the Supreme Court of the United States

October Term, 1983

RAILROAD DYNAMICS, INC.,
Petitioner,

v.

A. STUCKI COMPANY
Respondent.

Brief In Opposition To Petition For A Writ Of Certiorari To The United States Court Of Appeals For The Federal Circuit

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QUESTIONS PRESENTED

1. In a jury trial in which a patent's validity is contested, is it mandatory to submit special interrogatories in the nature of the factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1 (1966) to the jury when such submission is not required by the Federal Rules of Civil Procedure, the decisions of the Court of Appeals for the Third Circuit in which Circuit the case was tried, the decisions of subsequently created Court of Appeals for the Federal Circuit or the decisions of this Court?

2. In a case contesting a patent's validity, does the introduction of prior art alleged to be more pertinent than the prior art cited by the Patent Examiner *per se* adversely affect the presumption of validity (35 U.S.C. § 282) or, as held by the Court of Appeals for the Federal Circuit, does such alleged more pertinent prior art only constitute evidence relating to the patent challenger's duty to meet his burden of proof?

3. After a jury trial in which extensive testimony and documentary evidence was introduced by each party as to the validity of the patent in suit and the patent was held valid and the District Court denied Petitioner's post-trial motions, was the Court of Appeals for the Federal Circuit required to review the evidence introduced by Petitioner *de novo* and make an independent determination of the patent's validity without regard to the jury verdict in favor of Respondent and post-trial decision of the District Court denying Petitioner's motion for judgment NOV or for a new trial?

IDENTIFICATION OF AFFILIATE OF RESPONDENT

None.

TABLE OF CONTENTS

	Page
QUESTIONS PRESENTED	i
IDENTIFICATION OF AFFILIATE OF RESPONDENT	i
TABLE OF AUTHORITIES	iii
CONSTITUTIONAL PROVISIONS, STATUTES AND RULES INVOLVED	2
STATEMENT OF THE CASE	2
A. The Trial Presented Conflicting Evidence and Issues of the Credibility of Witnesses That Were Resolved Against Petitioner and in Favor of Respondent	2
B. Factual Background	3
C. Reasons for Not Granting the Writ	4
SUMMARY OF THE ARGUMENT	4
ARGUMENT: REASONS FOR DENYING THE PETITION	5
A. Neither the Federal Rules of Civil Procedure Nor Decisional Rules Mandate that in a Patent Validity Trial a Jury Must in All Cases Respond to Detailed Interrogatories	5
B. The Presumed Validity of a Patent Under 35 U.S.C. § 282 Is Not Affected Merely Upon the Introduction of Alleged More Pertinent and Uncited Prior Art	10
C. An Appellant to the CAFC Is Not Entitled to a *De Novo* Review of the Evidence Introduced in the District Court	13
CONCLUSION	20

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C-Suzanne Beauty Salon, Ltd. v. General Insurance Co. of America, 574 F.2d 106 (2nd Cir. 1978)..... 16

Graham v. John Deere Co., 383 U.S. 1, 86 S.Ct. 684, 15 L.Ed.2d 545 (1966) ..... i, 3, 5, 7, 8, 10

Graver Tank & Mfg. Co. v. Linde Air Products Co., 1 336 U.S. 271, 93 L.Ed. 572, 69 S.Ct. 535, 80 USPQ 451, (1949) adhered to *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 2 339 U.S. 605, 94 L.Ed. 1097, 70 S.Ct. 854, 85 USPQ 328, *reh. den. Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 340 U.S. 845, 95 L.Ed. 620, 71 S.Ct. 12 (1950) 17

Great A&P Tea Co. v. Supermarket Equip. Corp., 340 U.S. 147 (1950)..... 12

Lovelace v. Sherwin-Williams Co., 681 F.2d 230 (4th Cir. 1982) 16

Page

Medtronic, Inc. v. Cardiac Pacemakers, Inc.,
721 F.2d 1563 (CAFC 1983) 11

Perkin-Elmer Corp. v. Computervision Corp.,
(#83-1195, CAFC 4-6-84, *reh. den.* 5-2-84) 9, 11

Railroad Dynamics, Inc. v. A. Stucki Co.,
579 F. Supp. 353, 218 USPQ 618
(E.D. Pa. 1983) 1

Railroad Dynamics, Inc. v. A. Stucki Co.,
727 F.2d 1506 (CAFC 1984) 1

Rosenberg v. Trautwein, 624 F.2d 666
(5th Cir. 1980) 16

SSIH Equipment v. ITC, 718 F.2d 365,
218 USPQ 678 (CAFC 1983) 11

Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530,
218 USPQ 871 (CAFC 1983) 11

Union Carbide Corp. v. American Can Co.,
724 F.2d 1567 (CAFC 1984) 13, 14

UNITED STATES CONSTITUTION

Amendment 7 ..... 2, 15, 17

STATUTES AND REGULATIONS

Federal Courts Improvement Act of 1982,
P.L. 97-164 96 Stat. 37 15

Federal Rules of Civil Procedure
Rule 52(a) 17

35 U.S.C. § 103 ..... 5, 6, 18
§ 112 13
§ 282 ..... i, 10, 11

Page

MISCELLANEOUS

H. R. Rep. No. 97-312, 97th Cong., 1st Sess. 37 (1981) 16

9 C. Wright & A. Miller, *Federal Practice and Procedure:* Civil § 2524 (1971) 16

No. 83-1839

In the Supreme Court of the United States

October Term, 1983

RAILROAD DYNAMICS, INC.,
Petitioner,

v.

A. STUCKI COMPANY
Respondent.

Brief In Opposition To Petition For A Writ Of Certiorari To The United States Court Of Appeals For The Federal Circuit

Respondent respectfully requests that this Court deny the Petition for Writ of Certiorari seeking review of the United States Court of Appeals for the Federal Circuit's ("CAFC") decision in this case. That decision is recorded at 727 F.2d 1506 (CAFC 1984) and Appendix A, pages A-1 through A-33 of the Petition. The Order of the CAFC denying Petitioner's Petition for Rehearing and Suggestion for Rehearing *En Banc* and the Mandate are recorded at Appendix A, pages A-76 through A-77. The decision of the United States District Court for the Eastern District of Pennsylvania denying petitioner's post-trial motions is recorded at 579 F.Supp. 353, 218 U.S.P.Q. 618 (E.D. Pa. 1983) and Appendix A, pages A-34 through A-75.[1]

[1]Pages of the Petition are cited as "P. 5". Pages of the Petitioner's Appendix are cited as "A-1, A-2 . . . ". Pages of Trial Transcripts in the District Court which are not included in Petitioner's Appendix are cited as "T. 3.37-38". This refers to Volume 3, pages 37-38.

CONSTITUTIONAL PROVISIONS, STATUTES AND RULES INVOLVED

Amendment 7

Trial by jury in civil cases.

In Suits at common law, where the value in controversy shall exceed twenty dollars, the right of trial by jury shall be preserved, and no fact tried by a jury shall be otherwise re-examined in any Court of the United States, than according to the rules of the common law.

STATEMENT OF THE CASE

The Petition for a Writ of Certiorari is simply a third attempt to obtain a *de novo* review of Petitioner's evidence as to the validity of the patent in suit. The case does not involve a departure from the "accepted and usual course of judicial proceedings", or important questions of federal law not yet settled by the Supreme Court or a conflict with its own decisions to be resolved. Although Respondent agrees with Petitioner's Statement of the Case, except for Petitioner's characterization of its proposed interrogatories, the Statement is incomplete with respect to understanding the conduct of the trial and the issues.

A. The Trial Presented Conflicting Evidence And Issues Of The Credibility Of Witnesses That Were Resolved Against Petitioner And In Favor Of Respondent

Since Petitioner admitted infringement, Petitioner relied upon numerous defenses to establish the invalidity of the patent in suit by introducing substantial testimony through numerous witnesses and numerous exhibits. Similarly, Respondent introduced substantial testimony through various witnesses and numerous exhibits. The credibility of witnesses was an important issue; and, the

various issues were hotly contested issues as acknowledged by Petitioner (P. 6). At the close of the evidence, the law was explained to the jury precisely as set forth in *Graham v. John Deere*, after Petitioner participated in a lengthy consideration of the wording of interrogatories to be submitted to the jury (T. 14. 2-23) and the instructions to be given to the jury (T. 13.86-13.130). With regard to the instruction concerning the presumption of validity, Petitioner stated that the proposed instructions were fine and thanked the District Court Judge. (T. 14.23) Petitioner has not alleged that there was any error in the jury instructions; and, as noted by the CAFC, what is considered to be a few errors in the instructions were favorable to Petitioner (A-17).

Underlying Petitioner's attack on the use of interrogatories is Petitioner's contention that Petitioner need only establish patent invalidity by a "preponderance" of the evidence after the Petitioner had introduced prior art not cited by the Patent Examiner which Petitioner contended was "more pertinent". But neither the jury, District Court nor appeals court agreed with Petitioner that its uncited prior art was more pertinent. Thus, Petitioner's contention as to its burden of proof is based upon prior art held not to be more relevant than that cited by the Patent Examiner—a fact which Petitioner chooses to ignore.

B. Factual Background.

Petitioner includes a separate section in its Petition entitled, "Factual Background"; however, all of Petitioner's statements regarding the elements of the patent claims are not factual matters but are restatements of Petitioner's contentions which were rejected by the jury, the District Court and the CAFC. Such contentions of Petitioner will be discussed hereinafter.

C. Reasons for Not Granting the Writ.

The Petition should not be granted since the reasons for granting the Writ advanced by Petitioner relate to matters which are well settled and about which there is no controversy, and further review by the Supreme Court would not change the result in this case.

SUMMARY OF THE ARGUMENT

The true reason for the Petition is to obtain a fact finding redetermination by the Supreme Court favorable to Petitioner after having failed to convince the jury, District Court and CAFC to adopt Petitioner's contentions as to the facts. It goes without saying that a case should not be before the Supreme Court for such reason, hence Petitioner has advanced issues of alleged public importance: (1) should factual interrogatories in patent cases be made mandatory, (2) should the legally presumed validity of a patent be adversely affected or cease when uncited prior art is offered into evidence by the challenger and (3) is an Appellant to the CAFC entitled to have its evidence introduced at trial in the district court considered *de novo* by the CAFC without regard to the jury verdict and decision of the District Court?

Petitioner contends that the CAFC has decided these issues inconsistently or in conflict with prior decisions of other Circuit Courts of Appeal but an examination of the cases does not support Petitioner's statements. A fair reading of the decisions of the CAFC makes it clear that in all instances the Court has applied well accepted legal principles to the facts and that there is no reason for further review of this case. Prior decisions of other Circuit Courts of Appeal which may be in conflict are not binding on the CAFC and the decisions of the CAFC are not in conflict with any decision of the Supreme Court.

ARGUMENT: REASONS FOR DENYING THE PETITION

A. Neither the Federal Rules of Civil Procedure Nor Decisional Rules Mandate that in a Patent Validity Trial a Jury Must in All Cases Respond to Detailed Interrogatories

As is evident in the numerous decisions in patent cases subsequent to the holding of *Graham v. John Deere, supra,* the federal courts have, through proper instructions, required a jury to make the factual determinations set forth in *Graham v. John Deere* in determining obviousness under 35 U.S.C. § 103. The mandate of *Graham v. John Deere* is that the factual determinations be made in deciding obviousness; however, nowhere in *Graham v. John Deere* is it mandated that a jury must respond to special interrogatories directed to each of the *Graham v. John Deere* factual inquiries.

Petitioner does not contend that the special interrogatories employed by the District Court[2] were an abuse of discretion nor does Petitioner contend that special interrogatories in the nature of the factual inquiries set forth in *Graham v. John Deere* are mandatory. Petitioner's only contention is that since special interrogatories to such factual inquiries are recommended by the CAFC, this Court should determine:

> When is it necessary to submit to the jury interrogatories or special verdicts seeking answers in writing to the *Graham* inquiries, and when is it unnecessary to do so?

---

[2]In May/June 1980 when the case was tried on the validity issue, the CAFC did not exist and the District Court was under the jurisdiction of the Court of Appeals for the Third Circuit. The Third Circuit did not require the use of interrogatories. To adopt Petitioner's contention would require retrospective application of procedural rules.

(P.16)

In particular, Petitioner does not request any relief once this Court has decided when special interrogatories are necessary or unnecessary but only that this Court provide guidance for all future patent jury trials. (P.16) Thus, Petitioner does not set forth any basis to reverse the judgment of the CAFC.

Petitioner supports its request for this Court's clarification of when such special interrogatories are to be used by stating (P.8) that confusion exists by the conflicting decisions of two separate panels of the CAFC: one, in *American Hoist & Derrick Co. v. Sowa and Sons, Inc.*, 725 F.2d 1350 (CAFC 1984), and in the instant case. However, a reading of *American Hoist, supra,* establishes that the holding in that case is consistent with the holding in the instant case. Both these cases clearly state that such special interrogatories are desirable, but neither case mandates such special interrogatories.

In *American Hoist,* the CAFC panel clearly stated that the form of a jury verdict is normally a matter of discretion with the trial court and, as noted by one court, the failure to utilize such special interrogatories in a patent case places a heavy burden of convincing the reviewing court that the trial judge did not abuse his discretion. The *American Hoist* court continued by stating that, "The use of special interrogatories, as noted by the Fifth Circuit, id., facilitates appellate review . . .".

Further, in *American Hoist,* the trial judge stated that he was guided by the jury's findings in determining obviousness under 35 U.S.C. § 103. However, as pointed out by the CAFC, there were no express findings by which the District Court could have been guided. The *American*

Hoist court specifically set forth that the actions of the District Court should be compared to the procedure in which there was an independent review of the record by a District Court. *Cf. Control Components, Inc. v. Valtek, Inc.*, 609 F.2d 763, 768-69 (5th Cir. 1980).

Thus, although the *American Hoist* court recommended the *Graham v. John Deere* type of special interrogatories upon a new trial in order to facilitate review by both the District Court and the appellate court, *American Hoist*, did not mandate that special interrogatories must be utilized or otherwise its review would be precluded. The *American Hoist* court did not render any decision with respect to a district court judge who independently reviews the record to determine whether competent substantial evidence exists to support a jury's findings on the *Graham v. John Deere* factual inquiries.

In the instant case, the CAFC panel was in full accord with the *American Hoist* panel. Specifically, the CAFC stated (A-14) that:

> District courts have broad authority and discretion in conrolling the conduct of a trial. That authority extends to the form by which juries return verdicts, Fed.R.Civ.P. 49, and will not be interfered with unless an abuse of discretion is shown. *See Hammerquist v. Clarke's Sheet Metal, Inc.*, 658 F.2d 1319, 1322-23, 212 USPQ 481, 483 (9th Cir. 1981), *cert. denied sub nom. Carsonite International Corp. v. Carson Mfg. Co.*, 103 S. Ct. 1499 (1983); *Tights, Inc. v. Acme-McCrary Corp.*, 541 F.2d 1047, 1061, 191 USPQ 305, 314-15 (4th Cir.), *cert. denied sub nom. Kayser-Roth Corp. v. Tights, Inc.*, 429 U.S. 980 (1976). RDI has not shown that the use of the present "interrogatories" constituted an abuse of discretion requiring a new trial in this case.

The CAFC further stated (A-17) that:

> Failure to submit detailed fact interrogatories will not in every case result in the need for a new trial. Rule 49, Fed.R.Civ.P. The practice is nonetheless strongly recommended as an appropriate means of guiding a jury, increasing the reliability of its verdict, and facilitating the judicial role following a jury trial.

Thus, both the Court in *American Hoist* and in the instant case have held that *Graham v. John Deere* type special interrogatories, although desirable, are not essential in a patent case. The lack of special interrogatories, as has been noted by the CAFC, may place a heavier burden on the victor in sustaining the decision of the District Court, but, here, Petitioner can hardly complain that a heavier burden was upon Respondent.

Notwithstanding Petitioner's statements at page 10 of the Petition, the instant case did not come to the CAFC in the same posture as *American Hoist*. The District Court in the instant case devoted a substantial portion of its decision to the issue of "obviousness" (A-44 through A-54) and concluded (A-54):

> For all of the above reasons, it is this Court's finding that, had it been sitting in this case without a jury, we would have found that plaintiff failed to produce sufficient evidence to support its contention that the claimed invention would have been obvious to a person of ordinary skill in the relevant art at the time it was made, in light of the pertinent prior art. By the same token, the Court finds that the jury's determination that the plaintiff in this case failed to present sufficient evidence to show that the claimed invention was obvious is supported by the evidence.

Thus, the district court judge made an exhaustive independent review of the evidence relative to the issue of obvi-

ousness and reached his own independent conclusion that the invention was not obvious and that there was sufficient evidence to support the jury's verdict that the invention of the patent in suit was not obvious.

Petitioner further relies upon *Perkin-Elmer Corp. v. Computervision Corp.*, Appeal No. 83-1195 (CAFC, Slip Op. April 6, 1984, *rehearing denied* May 2, 1984), as another illustration of confusion in the decisions of the CAFC. The sentence quoted by Petitioner:

> To facilitate review of a motion for JNOV and on appeal, it is preferred that a jury be provided with special interrogatories designed to reveal more clearly the findings it made.

(P.12) is followed by the sentence,

> Absent such interrogatories, the law presumes the existence of findings necessary to support the verdict the jury reached.

Perkin-Elmer Corp. v. Computervision Corp., supra at p.8.

Obviously, the *Perkin-Elmer* court does not mandate special interrogatories in patent cases, but sets forth their desirability in order to facilitate judicial review. Such a holding is entirely consistent with the decision in this case and *American Hoist.*

Petitioner also states that in *Perkin-Elmer,* the CAFC engaged in a careful and independent review of the evidence on obviousness (P.12) and no such review of the evidence was performed by the CAFC in the instant case. In *Perkin-Elmer,* the CAFC incorporated a " . . . discussion of the prior art . . . " to illustrate the presence of substantial evidence to support the facts presumably found by the jury. There is no statement or suggestion in the decision that the *Perkin-Elmer* court made an independent review

of the prior art. In the instant case, the CAFC specifically referred to the decision of the district court judge as setting forth " . . . ample evidence favorable to Stucki . . . ". (A-11)

Although the CAFC has been consistent in noting the desirability of *Graham v. John Deere* type special interrogatories, the CAFC has also been consistent in holding that such special interrogatories are not essential in a patent case, albeit the verdict winner at trial may have a heavier burden upon appeal.

Petitioner also does not set forth any applicable federal rule or judicial decision which would, in May/June 1980, require a District Court in the Eastern District of Pennsylvania to submit *Graham v. John Deere* type special interrogatories to a jury. At the time of the liability phase of the trial, May/June 1980, the CAFC was not in existence and obviously had not rendered any decisions. Respondent does not know of any federal rule or Third Circuit decisional rule which required such special interrogatories during the May/June 1980 period. Thus, regardless of whether confusion presently exists between the holdings of the CAFC and the Circuit Courts, no such confusion existed in 1980 with regard to this case. Consequently, no grounds exist to reverse the judgment of the CAFC and there is no need for the "clarification" by this Court as requested by Petitioner.

B. The Presumed Validity of a Patent Under 35 U.S.C. § 282 Is Not Affected Merely Upon the Introduction of Alleged More Pertinent and Uncited Prior Art

Petitioner is requesting that the Supreme Court determine the appropriate burden of proof when one who challenges a patent's validity introduces prior art at trial which the challenger alleges is more pertinent than the prior art cited by the Patent Examiner. Again, Petitioner does not

request any relief once this Court has decided what effect alleged more pertinent prior art has on the presumption of validity. Nor does Petitioner contend that the jury was not properly instructed on the subject or that a different result will be obtained by this Court's resolution of Petitioner's request. Petitioner bases its request on the guidance such a decision will have upon all future patent validity trials (P. 12, 26).

Petitioner perceives (P.26) that this Court's determination of alleged more pertinent prior art *vis-a-vis* the presumption of validity "should also result in a reversal of the judgment in the instant proceeding". However, Petitioner does not set forth why reversal of the judgment of the CAFC or ultimately of the district court will occur based upon the requested consideration. Admittedly, on this point Petitioner agreed with the instructions to the jury (T. 14.23) and it is presumed that the jury followed the instructions and thus Petitioner cannot now complain.

The CAFC has consistently held that the presumption of validity is neither weakened nor destroyed by presenting prior art more pertinent than that considered by the Patent Office. The CAFC has consistently held that more pertinent prior art introduced by a party attacking the validity of a patent is more likely to enable the challenger to carry the burden of proving facts that clearly and convincingly establish a patent's invalidity. Section 282 does not mandate a different interpretation. *American Hoist* at 1360; *Perkin-Elmer, supra*; *Medtronic, Inc. v. Cardiac Pacemakers, Inc.*, 721 F.2d 1563 (CAFC 1983); *SSIH Equipment S.A. v. ITC*, 718 F.2d 365, 218 USPQ 678, 687 (CAFC 1983); *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871, 880 (CAFC 1983). Thus, the CAFC in keeping with its Congressional purpose has provided uniformity as to the interrelationship between the pre-

sumption of validity under 35 U.S.C. § 282 and more relevant prior art. On an issue upon which the CAFC has clearly and consistently spoken, there is no conflict to be resolved.

In this case, the jury was instructed that should the jury find that the prior art introduced by Petitioner was more pertinent than the prior art cited by the Patent Office, then the presumption of validity was weakened or overcome. (T.14.123) Thus, Petitioner has already had the benefit which it now seeks.

Further, Petitioner's position is based upon the premise that the prior art introduced by Petitioner was more pertinent than that cited by the Patent Office. The jury's verdict, as noted by the CAFC (A-18), clearly establishes that the prior art introduced by Petitioner was not more pertinent prior art. Consequently, Petitioner is in fact requesting this Court to reevaluate the prior art introduced by Petitioner. Accordingly, the Petitioner has set forth in detail in its Petition a summary and exhibits of selected portions of the prior art introduced by Petitioner to have this Court independently determine that such prior art is more relevant. However, at trial the prior art was examined in detail by experts for both parties, and their testimony was in conflict and had to be resolved. Petitioner has demonstrated no obvious and exceptional error and for this Court to do as requested by Petitioner would be contra to the "two court" rule. *See Beranyi v. Immigration Service*, 385 U.S. 630 (1967).[3]

[3]In a patent case, *Great A.&P. Tea Co. v. Supermarket Equip. Corp.*, 340 U.S. 147, 152-154 (1950) the Court reiterated that under the "two court" rule, when a matter is contingent upon resolving conflicting testimony, the Court "cannot undertake to review concurrent findings of fact by two courts below in the absence of a very obvious and exceptional showing of error. *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 336 U.S. 271, 276".

Petitioner further states that the presumption of validity cannot apply to an issue not considered by the Patent Office; and, therefore, as to such an issue, Petitioner's burden of proof is by a preponderance of the evidence. This argument relates to Petitioner's contention that the patentee did not set forth the "best mode" as required by 35 U.S.C. § 112. Again, Petitioner sets forth its contentions with respect to the "best mode" evidently for this Court to review and determine that the "best mode" was not described. Once this Court determines that the "best mode" is not described, then the Court is requested to hold that Petitioner was only under a preponderance requirement. As stated previously and as consistently held by the CAFC, the legal burden of proving invalidity is by clear and convincing evidence and evidence of invalidity does not change the effect of the presumption of validity. The presumption of validity is independent of the proofs of invalidity. To hold otherwise would require numerous decisions on the effect of evidence *vis-a-vis* the presumption of validity in specific instances.

C. An Appellant to the CAFC Is Not Entitled to a *De Novo* Review of the Evidence Introduced in the District Court

Petitioner maintains that since the ultimate conclusion of whether an invention is obvious is a matter of law, the CAFC has the duty to make an independent determination of the validity of the patent in suit. Petitioner cites prior holdings of this Court as to obviousness being a matter of law subject to review by an appellate court. Also, Petitioner cites *Union Carbide Corp. v. American Can Company*, 724 F.2d 1567, 1573 (CAFC 1984), and quotes from it the following:

> . . . this court reviews the issue of obviousness as one of law on which it *must* exercise independent judgment . . . [Emphasis added]

(p. 26).

The above quotation is the first part of a sentence which in its entirety states:

> . . . However, since this court reviews the issue of obviousness as one of law on which it must exercise independent judgment, the court must be convinced not only that the decision maker engaged in a faulty analysis in applying the law to the facts, but also that a correct application of the law to those facts would bring a different result . . .

Union Carbide Corp. v. American Can Company, supra at 1573.

Thus, the CAFC has not stated that it must make an independent judgment of the evidence relating to the issue of obviousness (as contended by Petitioner) but that the CAFC will review or reverse decisions when it is convinced that a faulty analysis has been made in applying the law when a correct application of the law would bring a different result.

Here, Petitioner chooses to ignore the issue of credibility of witnesses as to material facts, the jury's verdict and the decision of the District Court and would have the evidence as to obviousness evaluated solely by the CAFC without regard to any aspect of the credibility of live testimony. Petitioner seeks to have the CAFC consider the evidence in the same light as Petitioner contended at trial and which was rejected by both the jury and the District Court. In the instant case the CAFC responded to Petitioner's contention as follows:

> RDI says that because "the issue of obviousness is a legal conclusion, albeit based on evidence in the form of facts", that issue is "fully reviewable by this court *de novo*". The assertion is at best confusing. Every legal conclusion must be based on facts established by evidence. "*De novo*" review means a totally new fact-finding effort.

> We do not sit as fact-finders. Given the facts supported by substantial evidence, we are certainly at liberty, as is the trial court, to say that the jury committed an error of law in reaching its conclusion on obviousness when those facts will not in law support the conclusion. But that is quite another thing from what is desired by RDI.

(A-10)

Petitioner totally ignores the fact that a jury trial is a fundamental constitutional right of a litigant under the Seventh Amendment and that the jury's verdict is sacrosanct unless clearly unsupportable.

In enacting the Federal Courts Improvement Act of 1982, P.L. 97-164, creating the CAFC, comments made in the House of Representatives concerning the use and appointment of technical assistants are illuminating on the intended scope of review of the CAFC in adversary proceedings.

> It is important to understand and appreciate the fundamental difference between the use of technical judges in the ex parte appeals from the Patent and Trademark office which they now consider and a similar type of help for judges who are called upon to resolve technical issues in adversary patent infringement cases of the kind that will now be heard by the Court of Appeals for the Federal Circuit . . .
>
> However, to use these advisers in adversary patent infringement cases and have them review and assess the technical aspects of the evidence, as developed by the sworn testimony of witnesses and as covered by the findings of fact entered by the trial judge, is quite a different matter [from their use in Patent office appeals]. It is well established that factual issues in a patent case must be tried and decided by the trial

judge or a jury in precisely the same manner as such issues are tried in any other kind of a lawsuit. The technical aspects of a patent case are factual issues, and patent cases are reviewed in the circuit courts of appeals in the same manner as with other appeals.

Thus, it is the settled practice of the circuit courts of appeals in patent cases to honor and respect Rule 52(a) F.R.Civ.P., which provides that findings of fact may not be set aside unless clearly erroneous, giving due regard to the opportunity of the trial court to judge the credibility of witnesses. The circuit courts have repeatedly held that it is not their function to pass upon or consider de novo the evidence received at the trial or to weigh controverted evidence. For example, in *Hazeltine Research v. Admiral Corp.*, 183 F. 2d 953 (7th Cir. 1950), the court condemned the practice of briefing and arguing patent appeals in nisi prius proceedings and emphasized that its function "on review is no different than in any other kind of case." Where a case might have gone either way, the Seventh Circuit has said it will not ignore the entered findings and that it is not its function to make an independent analysis and determination of the factual issues is controversy. *O'Brien v. O'Brien,* F.2d 254, 255 (7th Cir. 1953).

H.R. Rep. No. 97-312, 97th Cong., 1st Sess. 37 (1981).

The standard of review that a court must follow in ruling on a motion for judgment notwithstanding the verdict has long been undisputed.[4] The rule is now stated as follows:

[4]It is equally clear that the same standard applies to an appellate court as to a trial court in ruling on a motion for JNOV. *See, e.g., Lovelace v. Sherwin-Williams Co.*, 681 F.2d 230, 237 n.5 (4th Cir. 1982); *Rosenberg v. Trautwein*, 624 F.2d 666, 669 (5th Cir. 1980); *C-Suzanne Beauty Salon, Ltd. v. General Insurance Co. of America*, 574 F.2d 106, 112 n.10 (2d Cir. 1978); 9 C. Wright & A. Miller, *Federal Practice and Procedure:* Civil § 2524 (1971).

> [A court is] bound to view the evidence in the light most favorable to [the non-moving party] and to give it the benefit of all inferences which the evidence fairly supports, even though contrary inferences might reasonably be drawn (*Continental Ore Co. v. Union Carbide & Carbon Corp.*, 370 U.S. 690, 696 (1962).

A prevailing litigant in a jury trial is protected by the Seventh Amendment from appellate redetermination of jury fact-findings and when a case has been tried non-jury in the District Court and that court has made appropriate findings of fact and conclusions of law, the Court of Appeals reviewing the judgment of the District Court is required to follow F.R.C.P., Rule 52(a) and to abide by the findings of the District Court unless clearly erroneous.

The Supreme Court has emphasized the importance in patent cases of respecting the superior perspective of the fact-finder at trial. *See Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 336 U.S. 271 (1949), in which this Court reversed an appellate court for failing to observe Rule 52(a) with respect to facts found by a trial court. As the Court in *Graver* observed, *see* 336 U.S. at 274-75, there is "no type of case" to which the limitations on appellate review of the facts are "more appropriately applicable" than to a patent case, where the facts are illuminated at trial by extensive expert testimony and live demonstrations of the devices at issue.

Here, the credibility of witnesses' testimony was very important. Numerous physical exhibits were explained or commented upon by experts. The direct testimony at trial of one of Petitioner's expert witnesses was pointed out on cross examination to be in direct conflict with a prior statement made under oath, and it was for the jury to resolve what of his testimony was to be believed. In its

decision, the District Court commented upon this evidence as undermining Petitioner's contentions. (A-51)

Accordingly, a *de novo* review of the evidence by the CAFC is totally inconsistent with the standard of review imposed upon the CAFC by the Constitution, the establishment of the CAFC and by the decisions of this Court.

Petitioner suggests that since this Court has not "shied away" from determining that a patent is invalid under the requirements of the patent statutes (P. 29), the Court should not shy away from determining that the patent in suit is obvious under 35 U.S.C. § 103. In order to permit this Court to make its own independent determination, Petitioner has submitted copies of various prior art patents and has colored portions of such prior art to support Petitioner's contention that the prior art "... conclusively proves the claimed invention obvious, thereby rendering the '292 patent invalid" (P.29). However, the coloring of the prior art is in a manner to mislead an observer into believing there is merit to Petitioner's contentions regarding such prior art. Petitioner also contends there is "no substantial evidence" (P.28) to refute the teachings of the prior art as Petitioner construes the prior art. Petitioner also maintained before the CAFC that there was "no evidence favorable to Stucki ... " (A-11). However, a review of the record establishes that the prior art relied upon by Petitioner does not show the claimed invention. The jury undoubtedly found that the evidence did not support Petitioner's contentions and the CAFC specifically noted that "The ample evidence favorable to Stucki [Respondent] is discussed by Judge Broderick at 579 F. Supp. 364-66, 218 USPQ 625-26" (A-11). Thus, Petitioner continues to ignore the disputed evidence and evidence favorable to Respondent to obtain this Court's review of a limited portion of Petitioner's evidence as selected by Petitioner.

The CAFC clearly stated that it did not sit as fact-finders (A-10) and, it if did so, a trial would be unnecessary as all that would be necessary would be for the parties to mail the patent and the prior art to the CAFC and ask for the CAFC's opinion on obviousness (A-11). Similarly, if the Supreme Court is to make a *de novo* review, not only is a trial unnecessary, but the review by the CAFC would be equally unnecessary. Further, if this Court is to make a *de novo* review, then the entire record must be reviewed since such record establishes that Petitioner's contentions as to the prior art are not in fact true.

CONCLUSION

For the foregoing reasons, Petitioner's request should be denied.

Respectfully submitted,

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(5)

No. 83-1839

IN THE
SUPREME COURT OF THE UNITED STATES

October Term, 1983

RAILROAD DYNAMICS, INC.,
Petitioner

v.

A. STUCKI COMPANY,
Respondent

ON WRIT OF CERTIORARI
TO THE UNITED STATES COURT OF
APPEALS FOR THE FEDERAL CIRCUIT

PETITIONER'S RESPONSE TO MOTION SEEKING DAMAGES UNDER RULE 49.2 FOR FRIVOLOUS APPLICATION FOR PETITION FOR WRIT OF CERTIORARI

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TABLE OF CONTENTS

Page

Table of Authorities..... ii

I. The Petition For Writ Of Certiorari Raises Important Questions Of Federal Law Given The Decision Below Of The New Court Of Appeals For The Federal Circuit Which Conflicts With Decisions Of Other Courts Of Appeal And Which Have Not Been But Should Be Settled By This Court..... 2

II. Issues Raised In The Present Petition Were Also Raised In Pending Petitions For Writs Of Certiorari To The CAFC In Other Cases..... 14

III. Petitioner's Conduct Does Not Objectively Establish That The Petition Was Filed In Bad Faith Solely To Delay Execution..... 16

IV. Conclusion..... 19

TABLE OF AUTHORITIES

Cases	Page
Calmar, Inc. v. Cook Chemical Co., 383 U.S. 1, 4-5 (1966)	9
Computervision Corp. v. The Perkin-Elmer Corp., Supreme Court Docket Number 84-173	15
Deming v. Carlisle Packing Co., 226 U.S. 102 (1912)	10
Graham v. John Deere Co., 383 U.S. 1, 17-18 (1966)	5,9, 11
Graver Tank & Mfg. Co. v. Linde Air Products Co., 336 U.S. 271 (1949) and 339 U.S. 605 (1949), reh. den. 340 U.S. 845 (1950)	8,9
Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp., 340 U.S. 147, 148 (1950)	9
Hyde Park Medical Laboratory, Inc. v. Illinois Department of Public Aid, 414 U.S. 1116 (1973)	12
Kahn v. Dynamics Corp. of America, 508 F.2d 939 (2nd Cir. 1974), cert. denied, 421 U.S. 930 (1975)	13

Reed v. Reed, 411 U.S. 904 (1973)...12

Sakraida v. Ag Pro, Inc., 425 U.S. 273, 279 (1976).....7

Sowa & Sons, Inc. v. American Hoist & Derrick Co., Supreme Court Docket Number 83-1827.....14

Technitrol, Inc. v. McManus, 395 U.S. 919 (1969).....12

White v. Jeffrey Mining Machinery Company, Supreme Court Docket Number 83-1913.....15

Supreme Court Rules

Rule 17.....3,4

Rule 21.....3

Rule 56(4).....12

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Respondent's Motion is based upon the allegedly frivolous nature of the Petition for a Writ of Certiorari (hereinafter "Petition") and the totally

unrelated conduct of Petitioner,[1] which conduct, Respondent claims, establishes that the Petition was filed in bad faith and solely to delay execution upon the outstanding judgment. Both contentions are groundless and frivolous. The following reasons are advanced in support of this response.

I. The Petition For Writ Of Certiorari Raises Important Questions Of Federal Law Given The Decision Below Of The New Court Of Appeals For The Federal Circuit Which Conflicts With Decisions Of Other Courts Of Appeal And Which Have Not Been But Should Be Settled By This Court.

Unquestionably, the Petition presents several considerations strongly warranting the grant of the requested Writ by this Court. The Petition is in full compliance with this Court's Rules

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[1] Worthington Industries, Inc. is an affiliate of Petitioner in that it owns 50% of the stock of Petitioner.

17 and 21 governing such considerations and the content of a Petition for a Writ of Certiorari. Respondent states that the Petition does not set forth or allege any error of any nature or any abuse of discretion which would result in any modification or reversal of the judgment from which Petitioner has requested review. Even if this were true, it is irrelevant.2/ The purpose of a

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2/ Errors of the appellate court below clearly were alleged in the Petition, for example at 7 ("illogical, unworkable, and inequitable position taken by the CAFC"); 10 ("overlooked, misapprehended or ignored the precedent"); 15 ("by not remanding . . . the CAFC in the present case rendered meaningful judicial review of the jury's verdict impossible"); 16 ("fails to comport with the CAFC and other courts' decisions"); 18 ("the CAFC's holding is both illogical and in direct conflict with . . . every other Circuit Court of Appeals"); 22 ("an improperly high burden of proof on Petitioner and therefore constituted reversible error"); 23 ("the trial court erred. . . . Likewise, when the CAFC approved the trial court's actions, it adopted a position which is in direct conflict with every other Circuit Court of Appeals that

(footnote continued)

petition for a writ of certiorari is to point out to this Court how a federal court of appeals has rendered a decision in conflict with that of another federal court of appeals on the same matter or has so far departed from the accepted and usual course of judicial proceedings or so far sanctioned such a departure by a lower court that this Court's supervisory powers should be exercised, or to decide an important question of federal law which has not been, but should be, settled by this Court, or to correct a federal court decision conflicting with decisions of this Court (Supreme Court Rule 17).

(footnote continued from previous page) has considered this issue"); 26 ("this Court's consideration . . . should result in a reversal of the judgment").

Even assuming the accuracy of Respondent's statement that the CAFC has consistently held that special interrogatories are advisable but not mandatory (disputed in the Petition at 8-10 and in the Reply Brief accompanying this Response, at 5-9), the CAFC's decision in the case at bar conflicts with decisions of the Courts of Appeal for the Sixth and Seventh Circuits, and apparently also the Fifth Circuit (Petition at 13-15), requiring submission to the jury of special interrogatories directed to the factual inquiries relating to obviousness as set forth in Graham v. John Deere Co., 383 U.S. 1, 17-18 (1966). These are not frivolous assertions.

Petitioner agrees with Respondent that the CAFC consistently has held that

the presumption of validity under 35 U.S.C. Section 282 remains constant, but is not weakened, overcome or destroyed by prior art more pertinent than that cited by the U.S. Patent and Trademark Office. The CAFC's position, however, is diametrically opposed to the position adopted by every other circuit and to the position of the United States Court of Claims, one of its predecessor courts (Petition at 18-19, n.11). Because of the CAFC's erroneous holding relating to a constant presumption of validity, regardless of the facts, Petitioner contended the CAFC erroneously approved the trial court's charge that Petitioner's burden of proof of patent invalidity would be by clear and convincing evidence, rather than by a pre-

ponderance of the evidence (Petition at 22-24).

The last issue that is raised in the Petition is the duty of an appellate court to review evidence independently to be able to render an informed decision as to whether or not substantial evidence supported the jury's verdict and, therefore, whether the trial court abused its discretion in denying a motion for judgment notwithstanding the verdict or for a new trial (Petition at 26-29; see also, Reply Brief at 11-14). This Court has held that there is a constitutional standard of patentability, Sakraida v. Ag Pro, Inc., 425 U.S. 273, 279 (1976). The CAFC has not adhered to this admonition in the case at bar and thereby has rendered an erroneous decision requiring reversal.

Respondent cites Graver Tank & Mfg. Co. v. Linde Air Products Co., 336 U.S. 271 (1949) and 339 U.S. 605 (1949), reh. den. 340 U.S. 845 (1950), for the proposition that the "two court" rule precludes this Court from reviewing prior art documents to make an independent determination that Respondent's patent is invalid. To the contrary, Petitioner submits that Graver Tank merely emphasizes the propriety of employing the clearly erroneous standard for fact determinations. Id., 336 U.S. at 275. In Graver Tank, this Court indicated that a court of law "cannot undertake to review concurrent findings of fact by two courts below in the absence of a very obvious and exceptional showing of error." Id. In the present case, the factfinder, namely, the jury, did not

find facts. The trial judge found facts and the facts he found were obviously and exceptionally erroneous. The CAFC did not independently review the record, but merely rubber stamped the trial judge. This procedure hardly represents "concurrent findings of fact by two courts below."

Moreover, this Court has not hesitated, even after Graver Tank, supra, to hold patents invalid as a matter of law even where both the trial court and appellate court determined them to be valid. See, Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp., 340 U.S. 147, 148 (1950); Calmar, Inc. v. Cook Chemical Co., decided concurrently with Graham v. John Deere Co., 383 U.S. 1, 4-5 (1966). An invalid patent cannot be allowed to stand.

Moreover, Deming v. Carlisle Packing Co., 226 U.S. 102 (1912), apparently cited by Respondent as support for a frivolous filing, is so factually divergent from the case at bar as to render that decision irrelevant here. Deming involved a petition for removal of an allegedly federal question from a state court to the federal court. The Court held that the federal question was "of such an unsubstantial character as to cause it to be devoid of all merit, and therefore frivolous," because the issue was "well-settled and indeed, now elementary doctrine" previously pointed out by this Court's prior decisions. Id. at 105. The case at bar bears no resemblance whatsoever to Deming.

This Court has never reviewed any decision of the CAFC since the CAFC was

established on October 1, 1982. Moreover, this Court has never decided the issue of whether the submission of the Graham factual inquiries to a jury as special interrogatories or special verdicts is required and has never construed the meaning of the presumption of validity under 35 U.S.C. Section 282. These issues raise important questions of federal law which have not been settled by this Court and which must be decided by this Court, given that the CAFC's decision in the case at bar conflicts directly with decisions on these issues rendered by other Circuit Courts of Appeal.

Petitioner's research has indicated that there have been no published decisions relating to motions under this Court's Rule 49.2. Further, this

Court's decisions under Rule 56(4), the predecessor to Rule 49.2, summarily denied motions for damages, fees and costs. Hyde Park Medical Laboratory, Inc. v. Illinois Department of Public Aid, 414 U.S. 1116 (1973); Reed v. Reed, 411 U.S. 904 (1973); Technitrol, Inc. v. McManus, 395 U.S. 919 (1969). For all the reasons set forth above, it is respectfully requested that Respondent's Motion likewise be denied.

Furthermore, Respondent attempts to bootstrap its argument that the Petition is frivolous by citing the trial judge's memorandum of March 8, 1984, which speculates that it is extremely unlikely that the Petition would be granted. The quotation is taken entirely out of context. On March 8, 1984, the Petition was not completed and was never pre-

sented to the trial court. The Petition was not filed with this Court until May 11, 1984. Further, the trial court's speculation as to the likelihood that the Petition would not be granted was based only upon a statement by the CAFC regarding a minor issue raised during the trial, which was not raised on appeal by either party, the issue of late claiming with respect to which Petitioner cited Kahn v. Dynamics Corp. of America, 508 F.2d 939 (2nd Cir. 1974), cert. denied, 421 U.S. 930 (1975). That issue is not before this Court and was not briefed or argued before the CAFC.3/

3/ Respondent also quotes the CAFC's decision in the case at bar, 727 F.2d 1506 at 1520, in which the CAFC criticized counsel for approaching the zenith of zeal in representing Petitioner. This comment was also directed to the issue of late claiming which the CAFC raised sua sponte and which is not raised in the Petition.

II. Issues Raised In The Present Petition Were Also Raised In Pending Petitions For Writs Of Certiorari To The CAFC In Other Cases.

Other Petitions for Writs of Certiorari to the CAFC presently pending before this Court raise issues identical to or similar to at least one of the issues raised by Petitioner and attacked as frivolous. The fact that other petitioners have raised the same or similar issues resulting from other decisions of the CAFC is a further indication that the present Petition is not frivolous.

In Number 83-1827, Sowa & Sons, Inc. v. American Hoist & Derrick Co., the issues presented are the CAFC's interpretation of the presumption of validity under 35 U.S.C. Section 282 and the requirement that only special interrogatories, rather than general verdicts,

be submitted to the jury to determine the issue of obviousness. The same questions were presented in the case at bar. In Number 84-173, Computervision Corp. v. The Perkin-Elmer Corp., and in Number 83-1913, White v. Jeffrey Mining Machinery Company, the petitioners raise the issue of the nature and scope of the CAFC's review of jury determinations relating to the obviousness issue. This is the third issue raised by Petitioner in the case at bar.

The filing of several other Petitions for Writs of Certiorari raising the same or similar issues based on decisions of the same court indicate not only that the present Petition is not frivolous, but also mandates that the Writ be granted. Without doubt, the

issues raised by Petitioner are important and of great merit.

III. Petitioner's Conduct Does Not Objectively Establish That The Petition Was Filed In Bad Faith Solely To Delay Execution.

Petitioner is fighting for its life, but is doing so reasonably and fairly, unlike Respondent, which is trying to destroy Petitioner. Petitioner was forced into bankruptcy solely as a result of the adverse decisions in the present case. On August 28, 1984, pursuant to a motion filed by Respondent in the United States Bankruptcy Court for the Eastern District of Pennsylvania, the Chapter 11 reorganization proceeding involving Petitioner was converted to a Chapter 7 liquidation proceeding. However, despite the adversities which have beset it, Petitioner has consistently

acted properly, in full conformance with the law, in an attempt to redress what it sincerely believes are erroneous decisions by the lower courts. If the Petition is granted and the erroneous decisions below are reversed, Petitioner will again be a viable company. Petitioner in good faith believes this will occur.

Respondent's arguments that Petitioner's conduct establishes the bad faith filing of the Petition are absurd. Such conduct, allegedly including the filing of a petition in bankruptcy under Chapter 11, Petitioner's attorneys seeking compensation for preparing and filing the Petition, and payments to Petitioner's stockholders through 1982 (about two years or more before the filing of the Petition), cannot and does

not, in any manner, indicate that the Petition was filed in bad faith. To the contrary, the assertion of these allegations by Respondent illustrates, in stark terms, the repeated actions taken by Respondent to harass Petitioner and its attorneys through the filing of groundless documents based on unreasonable and irrelevant arguments.

Finally, that the Petition is not frivolous is further indicated by Respondent's own actions in filing a brief in opposition to it, rather than merely filing the present motion. This plainly evidences that Respondent's present Motion was an afterthought, filed with the hope that no response would be filed due to Petitioner's financial condition. Further, the filing and timing of the present Motion, after the conversion of

the bankruptcy proceedings from Chapter 11 to Chapter 7, when Petitioner is at its weakest due to the inability to pay counsel, are other indications of Respondent's harassment of Petitioner, its officers and attorneys.

IV. Conclusion.

For the reasons set forth above and as are clearly apparent from a review of the Petition and the Reply Brief in support of it, the Petition is not frivolous and was not filed in bad faith and, in fact, should be granted so that this Court may pass upon the significant federal patent law issues raised therein and in other petitions presently pending before the Court. Therefore, it is respectfully requested that Respondent's Motion seeking damages under Rule 49.2

be denied and that damages, costs and attorneys fees be awarded to Petitioner to reimburse it for the attorney fees and expenses incurred in responding to Respondent's frivolous Motion.

Respectfully submitted,

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REPLY BRIEF IN SUPPORT OF PETITION FOR WRIT OF CERTIORARI

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TABLE OF CONTENTS

Page

Table of Authorities.....(ii)

1. Contrary to Respondent's Assertions, Petitioner Did Not Agree That the Jury Instructions Were Without Error..... 2

2. Respondent Has Mischaracterized and Misinterpreted the Conflict Within the CAFC Concerning the Requirement For The Use of Jury Interrogatories..... 5

3. It is Irrelevant Whether or Not, at the Time of Trial, the District Court Was Required by Then-Existing Precedent or Rule in the Third Circuit to Submit to the Jury Special Interrogatories..... 9

4. An Independent Analysis of the Legal Determination of Obviousness by the CAFC Would Have Revealed That Respondent's Patented Invention Was Obvious and Its Patent Invalid..... 11

5. A Petitioner Need Not Demand Specific Relief in a Petition for a Writ of Certiorari..... 15

6. Conclusion..... 16

TABLE OF AUTHORITIES

Cases	Page
American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350 (Fed. Cir. 1984)	5,6,7, 8,10
Dual Manufacturing & Engineering, Inc. v. Burris Industries, Inc., 619 F.2d 660, 667 (7th Cir.), cert. denied 449 U.S. 870 (1980)	10
Graham v. John Deere Co., 383 U.S. 1, 17-18 (1966)	3,7,8, 10,11, 12
Jervis B. Webb Co. v. Southern Systems, Inc., Appeal No. 84-568 (Fed. Cir., August 16, 1984), Slip Op'n at 8-16	14
Perkin-Elmer Corp. v. Computer-vision Corp., ___ F.2d ___, 221 USPQ 669, 675-677 (Fed. Cir. 1984)	12,13, 14
Roberts v. Sears, Roebuck & Co., 723 F.2d 1324, 1343 (7th Cir. 1983)	10

Other Authorities

Supreme Court Rule 17.....15

Supreme Court Rule 21.....15

Supreme Court Rule 34.....16

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Petitioner hereby respectfully replies to the following mischaracterizations and unanticipated new arguments set forth in Respondent's Brief in Opposition to Petition for a Writ of Certiorari to the

United States Court of Appeals for the Federal Circuit ("Opposition Brief"). That Petitioner does not reply herein to any issues or arguments raised in the Opposition Brief does not indicate Petitioner's acquiescence therein or agreement therewith.[1/]

1. **Contrary to Respondent's Assertions, Petitioner Did Not Agree That the Jury Instructions Were Without Error.**

Respondent argues that Petitioner cannot now contend that the jury instructions in the case were in error since Petitioner acquiesced to their use at trial. This argument is based upon a drastic mischaracterization of one statement made by counsel during a discussion with the trial court relating to one small aspect of the instructions where the judge

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1/ The abbreviations used in the Petition will be used herein (see footnotes 1, 3 and 5 thereof), except that pages of the Opposition Brief are cited as, for example, "O.B. 1."

indicated he would instruct the jury that he would use the word "overcome" rather than "destroyed" with respect to the presumption of validity. Counsel for Petitioner stated that the use of that word was "fine" (T. 14.22-.23). At O.B. 3 and 11, Respondent has taken this limited exchange with the court entirely out of context in an attempt to obscure the many objections made by Petitioner to the charge to the jury, not only after the charge (T. 14.148-.149), but also during a motion for a directed verdict and during discussions with the court of the proposed instructions.

Petitioner timely objected to submitting the legal determination of obviousness to the jury, rather than submitting to the jury only the factual inquiries underlying such a determination as set forth in Graham v. John Deere Co., 383

U.S. 1, 17-18 (1966). (Plaintiff's Memorandum on Obviousness as a Question of Law, District Court Docket Entry No. 157; Plaintiff's Memorandum in Opposition to Defendant's Request for Instructions to the Jury, District Court Docket Entry No. 150; T. 6.49; T. 1.148-.149). Specific objections were made to the proposed instructions and to the instructions as actually given with respect to the presumption of validity (Memoranda entered as Docket Entry Nos. 150 and 157; T. 13.74; 13.89-.90; 14.95-.96; 14.148-.149). For example, at T. 13.89-.90, a specific objection was made to the proposed instruction that Petitioner had the burden by clear and convincing evidence, rather than by a preponderance of the evidence, to overcome the presumption of validity of Respondent's patent, particularly where the Petitioner relied upon much more per-

tinent prior art than that relied upon by the patent examiner.

It is clear that Petitioner never agreed and does not now agree with the instructions given to the jury in this case and particularly with those portions of the instructions relating to the submission of the legal issue of obviousness to the jury and the Petitioner's burden of proof in view of the misinterpretation of the presumption of validity.

2. Respondent Has Mischaracterized and Misinterpreted the Conflict Within the CAFC Concerning the Requirement For The Use of Jury Interrogatories.

Respondent devotes several pages (O.B. 6-9) in an effort to obfuscate the essential differences between the CAFC decisions in the case at bar and in American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350 (Fed. Cir. 1984). Respondent states blithely that the holding in

American Hoist "is consistent with the holding in the instant case," and that both cases "clearly state that such special interrogatories are desirable, but neither case mandates such special interrogatories" (O.B. 6).

While there is some overlapping language in both cases, the most startling consistency between the two cases is the procedure in the trial court. In both cases, the jury returned answers to written interrogatories addressed to ultimate legal issues, namely, patent validity (American Hoist, supra, 725 F.2d at 1354; Railroad Dynamics, at A-26). Because the interrogatories were directed to the legal issues of obviousness and patent validity, and not the underlying factual elements relating thereto, in neither case were there express findings of fact made by the jury (American Hoist, 725 F.2d at 1361;

Railroad Dynamics at A-15). In each case, the district judge set forth his own findings of fact relating to the Graham inquiries on the scope and content of the prior art, the level of ordinary skill, and the differences between the claimed invention and the prior art (American Hoist, 725 F.2d at 1361; Railroad Dynamics at A-16 and A-45-54). The trial court in both cases refused to grant motions for judgment notwithstanding the verdict or for a new trial. This is the end of the similarities which exist between the cases.

Although the panels of the CAFC in both American Hoist and the case at bar recommended the use of special interrogatories to obtain express factual findings by the jury underlying the obviousness determination, the CAFC in the present case held special interrogatories were not

essential and thereupon affirmed the trial court (A-17). A contrary holding and result occurred in American Hoist. There (725 F.2d at 1356), the CAFC reversed the trial court and ordered a new trial on the ground that general verdict forms, without the use of special interrogatories on the controlling facts patterned on Graham, were employed below.

Further, in the case at bar, the CAFC specifically approved the role reversal of judge and jury in which the trial judge finds the facts and the jury determines the legal conclusion of obviousness and validity, upholding the trial court's findings of fact so long as there is sufficient evidence of record to support the jury's implied findings (A-16). Again, the exact opposite holding in precisely similar circumstances, was rendered by the CAFC in American Hoist:

> The court seems to have turned the respective roles of judge and jury upside down. We caution that the role of the jury as fact-finder must not be usurped. 725 F.2d at 1351.

In view of the foregoing, Respondent's effort to obscure the contradictory holdings of two consecutive Federal Circuit decisions on substantially the same issues should be apparent. Accordingly, Respondent's argument should be disregarded.

3. It is Irrelevant Whether or Not, at the Time of Trial, the District Court Was Required by Then-Existing Precedent or Rule in the Third Circuit to Submit to the Jury Special Interrogatories.

Respondent alleged that, because the Third Circuit did not require submission of interrogatories to the jury on the factual issues underlying obviousness, the Distict Court for the Eastern District of Pennsylvania did not abuse its discretion in failing to do so in this case and contends that to hold otherwise would require

retrospective application of procedural rules (O.B. 5 at n.2, 10). This argument is totally without merit.

At the time of the trial in the American Hoist decision, supra, the Ninth Circuit did not require the use of special interrogatories. Nevertheless, the CAFC reversed the trial court in view of the trial court's failure to submit the factual inquiries of Graham to the jury.

Further, the same is true with respect to other circuit courts which have required the use of special interrogatories relating to the factual matters. See, Dual Manufacturing & Engineering, Inc. v. Burris Industries, Inc., 619 F.2d 660, 667 (7th Cir.), cert. denied 449 U.S. 870 (1980); Roberts v. Sears, Roebuck & Co., 723 F.2d 1324, 1343 (7th Cir. 1983). The time has come to unify the law and correct the errors of the courts below by revers-

ing the CAFC decision and remanding for a new trial properly submitting the factual inquiries to the jury.

Finally, the submission of Graham interrogatories is based not upon any procedural rule but instead upon this Court's decision in Graham and its applicability in the context of jury trials. The presence or absence of circuit court precedent or rules is irrelevant to the issue.

4. An Independent Analysis of the Legal Determination of Obviousness by the CAFC Would Have Revealed That Res-pondent's Patented Invention Was Obvious and Its Patent Invalid.

Respondent alleges that the CAFC's adoption of the district court's view of the evidence (A-11) satisfied the CAFC's duty to independently review and analyze the prior art and other aspects relating to obviousness to confirm whether or not substantial evidence supported the jury's

verdict and the trial court's denial of motions for judgment notwithstanding the verdict or a new trial (O.B. 10). Further, Respondent alleges that this is in accord with standard CAFC practice in other cases, such as Perkin-Elmer Corp. v. Computervision Corp., ___ F.2d ___, 221 USPQ 669, 675-677 (Fed. Cir. 1984). Respondent stated that the discussion of the prior art in Perkin-Elmer was merely to illustrate the presence of substantial evidence to support the facts presumably found by the jury (O.B. 9).

Respondent misunderstood the intent and import of Petitioner's argument on this point. Because obviousness, bearing on patent validity, is a matter of law, Graham, supra, 383 U.S. at 17, the CAFC should analyze carefully the prior art and other factors to see if the facts and law support the district court's conclusion.

In the present case, the CAFC merely accepted the statements of the district judge as set forth in the opinion denying Petitioner's post-trial motions, despite the many errors relating to the technology which are contained in the district judge's opinion as pointed out in detailed briefs to the CAFC. Rather than addressing these points or presenting an independent analysis refuting the contentions of error, the CAFC merely accepted the trial court's view of the evidence, which was not necessarily the jury's view and which was erroneous. This practice is not in accordance with proper appellate review and conflicts with prior and subsequent CAFC decisions.

One example of such a decision was Perkin-Elmer, supra, where the CAFC discussed the prior art in detail, unlike its procedure in the case at bar. It is ir-

relevant whether or not the discussion was for the purpose of illustrating the presence of substantial evidence supporting the facts presumably found by the jury in Perkin-Elmer. No such discussion was set forth here.

Another example of the CAFC's obligation to independently review the trial court's determination of obviousness (following a bench trial) is set forth in Jervis B. Webb Co. v. Southern Systems, Inc., Appeal No. 84-568 (Fed. Cir., August 16, 1984), Slip Op'n at 8-16. It is most significant that, following a full factual review, the court stated:

> A determination of obviousness is a question of law that is subject to a full and independent review by an appellate court. Id., at 8.

The refusal of the CAFC to make such an independent review in this case is error and reversal is therefore required.

5. A Petitioner Need Not Demand Specific Relief in a Petition for a Writ of Certiorari.

At several points in its brief, Respondent argued that Petitioner had not requested specific relief in its Petition, but instead was seeking guidance, clarification, and review of the issues raised in the Petition (O.B. 5, 6, 10-11).

This Court's Rule 17 sets forth the considerations governing review on certiorari. Rule 21 sets forth the required contents for a petition for a writ of certiorari. Nowhere in those or any other Supreme Court Rules is it specified that a demand for relief must be contained in the petition.

After the Petition is granted and this Court in its discretion decides to review the issues presented, a brief on the merits will be filed. Such a brief will include a "conclusion, specifying with

particularity the relief to which the party believes himself entitled" (Supreme Court Rule 34). Thus, the appropriate time for specifically requesting relief is after the Petition for a Writ of Certiorari has been granted, and not in the Petition itself.

Despite the above, it is clear that the Petitioner seeks reversal of the CAFC's holding in this case and a remand of this matter to either the CAFC or the trial court for a new trial, depending upon the precise issue upon which relief is granted.

6. Conclusion.

For the reasons set forth above and in the Petition for a Writ of Certiorari, a Writ of Certiorari should issue to the Court of Appeals for the Federal Circuit.

Respectfully submitted,

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